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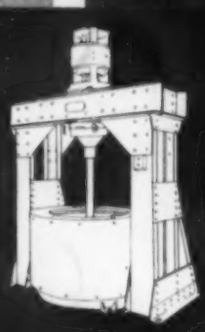

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VOLUME THIRTY-FIVE · NUMBER TWELVE

DECEMBER, 1928

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DIETHYLENE GLYCOL

DIETHYLENE Glycol has found extensive use in the manufacture of composition cork, as a solvent for dyes, resins and waxes and as a lubricant useful in the spinning of fiber and textiles. On nitration it yields Dinitro Diethylene Glycol which is an important explosive. It is an excellent wetting agent and for this reason has been widely used in the printing of textiles. It is a solvent for nitrocellulose and many organic liquids. It may be used in the manufacture of synthetic resins, particularly of the Glyptal type, conferring certain advantages upon resins so prepared.

These uses are merely a few of the many that have been developed during the short period of time that Diethylene Glycol has been commercially available. Undoubtedly there are still many other places in which it could be used to advantage. The cost is lower than that of competitive materials.

The properties of this interesting compound are set forth below in order that you may more intelligently determine its applicability to your problem.

Properties—Diethylene Glycol is a colorless, odorless compound, miscible in all proportions with water, alcohols, acetone, esters, ethylene dichloride, chloroform, nitrobenzene, aniline, etc. It is immiscible with ether, benzene, toluene, carbon bisulfide, carbon tetrachloride.

Boiling point, 245° @ 760 mm.
Melting point, —10.45°C
Specific gravity, 1.1212 @ 15°/15°
Specific heat, 0.555 @ 25°C
Flash point, 124°C—255.2°F
Fire point, 137°C—278.6°F
Latent heat of evaporation, 150 cal/gr. 244°C
Surface tension, 48.5 dynes per sq. cm.
Viscosity, 0.50 poises at 15°C

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Unit of Union Carbide and Carbon Corporation

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COMPACT SIFTERS and SCREENS

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SUGAR INDUSTRY

The accurate screening of sugar is a difficult job, especially on the finer meshes, so it is natural that the level gyrating ROTEX Screen is well established in this field.

One large refiner of cane sugar is using fourteen ROTEX Screens in his various plants for making 30 and 45 mesh separations on sugar, and also for screening bone char.

A manufacturer of children's food has been using ROTEX for five years, screening malt sugar and similar materials. In this time he has placed five repeat orders for ROTEX. We feel that this speaks for itself.

Out in the west, a large producer of corn sugar is using standard ROTEX for screening corn sugar thru 30 mesh screen. Their machines have been in service for two years giving large capacity and complete satisfaction at all times.

These installations prove the ability of the ROTEX to handle the various types of work in the sugar industry.

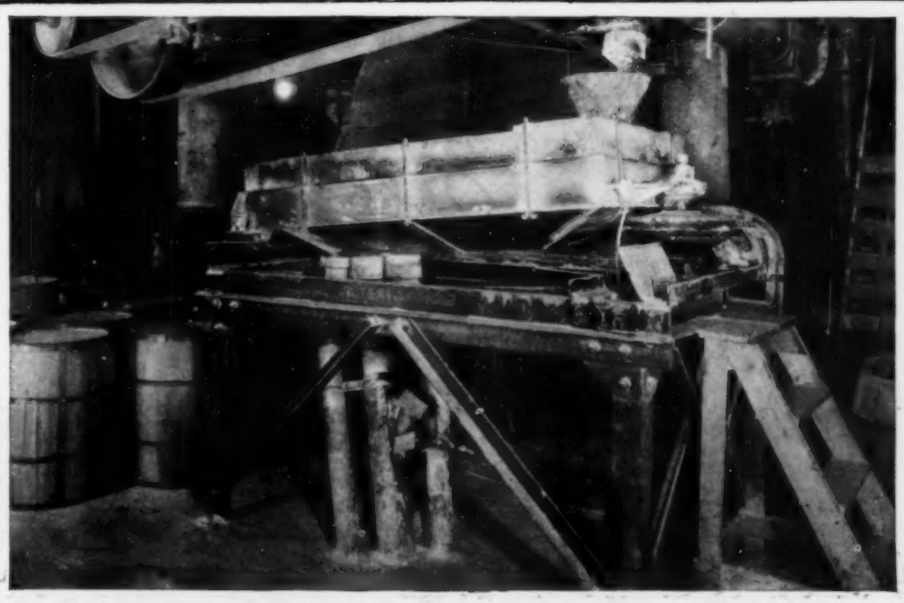
In the same way, we can demonstrate its ability and versatility in every industry where mechanical separation is required.

For accuracy, capacity and reliability the ROTEX Screen cannot be equalled.

Send for our Catalog No. 80

The
ORVILLE SIMPSON COMPANY
Office and Factory
1252 KNOWLTON ST. CINCINNATI, OHIO

At The National Sugar Co.



THE ELECTRONIC TORNADO

A process of automatic arc welding which represents a distinct advance in the welding art

THE Electronic Tornado Process of automatic carbon arc welding is now available for manufacturers of tanks, boilers, steel pipe and any products where steel is to be joined to steel on a production basis.

We shall welcome an opportunity to prove that welds made by this process develop greater strength and are more ductile than welds made by any other commercial process . . . that welding speeds are greater than by other welding methods . . . that the process is adaptable for either light sheet or heavy plate . . . and that the cost is lower than by any other known method.

Since welding speeds are high the cost per foot of weld is low. On ½ inch plate the rate of welding is 25 feet per hour.

The crystalline structure of welds made by the Electronic Tornado Process is remarkably fine and uniform and the metal in the weld is actually superior to the parent metal.

Microphotographs of sections through the fusion zone show a gradual transition from the crystalline structure of the parent metal to that of the weld metal. In no place is the metal weakened by the welding process.

Space does not permit a description of the process itself. However, a descriptive bulletin covering the Electronic Tornado is available and will be sent on request.

J. F. Lincoln

Vice President and General Manager

THE LINCOLN ELECTRIC COMPANY

CLEVELAND, OHIO

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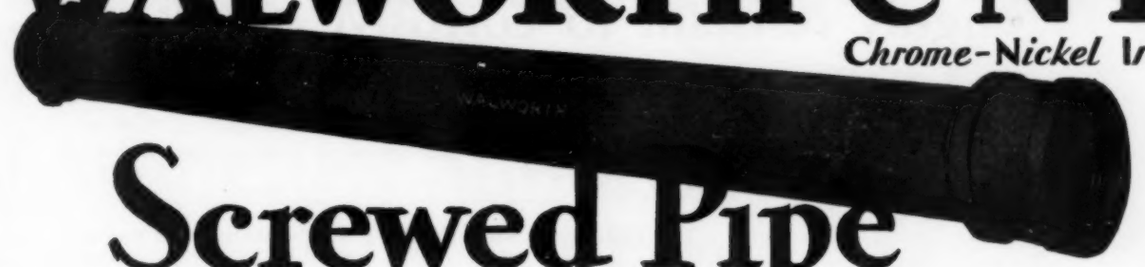
WALWORTH C·N·I

Chrome-Nickel Iron



Screwed Pipe

C.N.I. FITTINGS. SCREWED OR FLANGED ARE AVAILABLE

This folder will tell you all about it

WALWORTH BRINGS OUT A NEW PIPE OF IMPORTANCE TO INDUSTRY
AN ALLOY CAST IRON WITH VASTLY
GREATER STRENGTH
Has all the virtues of, and important additional advantages over, ordinary cast iron
Every Length Air Tested Under Water
Walworth C.N.I. Screwed Pipe is especially recommended for acid sludge lines, condenser box coils, run-down lines, buried lines in corrosive soils, submerged lines (fresh or salt water) and treating plants.

This Request Blank will bring you a copy by return mail

Walworth Company, 51 E. 42nd St., New York, N. Y.

I'd like to have one of the announcement folders on Walworth C.N.I. Screwed Pipe

(Please check size of pipe you are interested in)
Other sizes will be available soon

2 in..... 2½ in..... 3 in..... 4 in..... 6 in.....

Name.....

.....Position.....

Address.....

SEAMLESS ENDURO 18-8

18% Chromium 8% Nickel

TUBES AND PIPING

Highly resistant to corrosive attack

SEAMLESS piping and tubes of Enduro 18-8 are immune from attack by many of the common corrosive media encountered in the chemical and process industries.

The following table showing the behavior in a number of reagents of an almost identical alloy analyzing 18% chromium and 8% nickel has been published by Dr. W. H. Hatfield:

Reagent	*Result*
All Fruit Acids	Unaffected
Acetic	Unaffected
Acetic Vapor 33%	Slight Attack
Citric	Unaffected
Milk (fresh or sour)	Unaffected
Nitric	Unaffected
Oleic	Unaffected
Picric	Unaffected
Stearic	Unaffected
Alum	Unaffected
Ammonium Nitrate	Unaffected
Salt Water	Unaffected
(Intermittent spray)	Very Slight Attack
Sodium Nitrate	Unaffected
Oxalic	Unaffected

Statements in this table should be considered as general and subject to some variations in specific cases due to the effect of factors such as pressure, temperature and minor impurities in the corrosive liquids.

Enduro 18-8 is a corrosion resisting and high temperature resisting alloy manufactured by the Central Alloy Steel Corporation, and is fabricated into seamless tubes and pipe exclusively by The Babcock & Wilcox Tube Company.

Seamless tubular material and castings of Enduro 18-8 are recommended for use in the following industries: Nitric Acid, Powder and Explosives, Artificial Silk, Pulp and Paper, Food Products, Dyes and Dyestuffs, Oil Refining, Chemical Machinery, and for Condensers and Evaporators.

Seamless piping and tubes of Enduro 18-8 are also highly resistant to oxidation and maintain great strength at high temperatures, are entirely free from embrittlement after protracted service at high temperatures—are easily worked, and are weldable by arc or gas.

Babcock & Wilcox Engineers will be glad to discuss your corrosion and high temperature problems with you, and supply complete information on the advantages of Seamless Enduro 18-8, and castings of similar analysis.

THE BABCOCK & WILCOX TUBE CO.

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Fluid Products...light, heavy or semi-solid can be mixed thoroughly, uniformly, economically, and in less time with

LIGHTNIN MIXERS

Geared type heavy duty portable mixer, ball bearing throughout, 1/3 to 5 H.P., 250 to 440 R.P.M.

THOUSANDS IN USE

The Propellers are scientifically arranged at a downward oblique angle. This downward and diagonal thrust of the propeller blades forces the mix against the sides and bottom of the container causing a combined turnover and rotation of the mix in two directions at the same time. This principle eliminates the necessity of baffle plates and gives a result obtainable only with Lightnin Mixers.

Direct drive portable type 1/20 to 5 H.P., 750 to 3600 R.P.M.

PATENTS PENDING

Patented side angular propeller type agitator for fixed installations on tanks of any size or shape 1/2 to 100 H. P. or more.

Nearly 20 years' experience justifies us in suggesting that you consult with us on your mixing problems.

MIXING EQUIPMENT CO., INC.

229 East 38th St., New York, N. Y.

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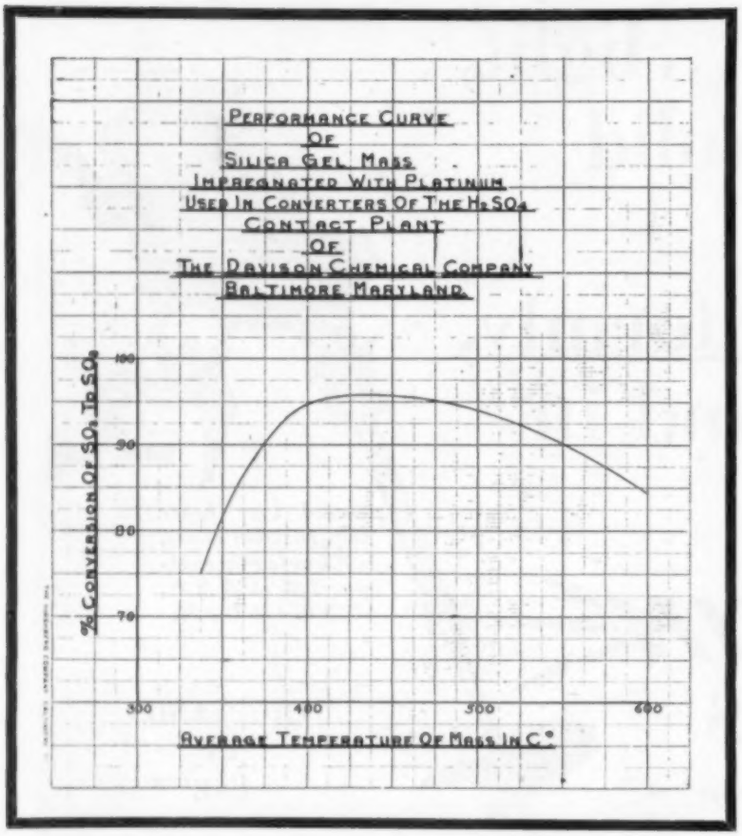

The most economical and suitable mass for converters of Sulphuric Acid Contact Plants is

PLATINIZED SILICA GEL MASS

Catalyzing agent not poisoned by arsenic.
Its use insures freedom from trouble in converters due to moisture condensation following a shutdown.

LONG LIFE **HIGH CONVERSION**

LARGE OVERLOAD CAPACITY

Submit inquiries and details to

THE SILICA GEL CORPORATION

1100 Garrett Bldg., Baltimore, Md.

Jeffrey Conveyors Saved Floor Space

Saving floor space in the plant is occasionally as important as saving men or power.

At the Columbus Union Oil Cloth Company six carloads of English china clay had to be stored near the mixing vats. Wheeling in and piling the clay from the wheelbarrows made a shallow storage pile spread over a wide and expensive floor space.

Then they installed a Jeffrey Spiral Conveyor, a Jeffrey Bucket Elevator and a Jeffrey Scraper Conveyor that takes the clay from the unloading hopper to a storage room.

These three conveyors are beyond the outer walls and roof of the plant and take up no floor space themselves. They carry the clay up and over the storage room and drop it in from above, greatly increasing the amount of clay that can be piled in a given floor space.

The seven hundred ton storage room is only sixty-nine feet long by thirty-three feet wide. This Jeffrey Equipment was installed in 1919 and has given continuous service ever since. Jeffrey engineers designed it.

The Jeffrey Manufacturing Company
909-99 North Fourth St., Columbus, Ohio

New York, Buffalo, Rochester, N. Y., Philadelphia, Pittsburgh, Scranton, Pa., Boston, Cincinnati, Cleveland, Detroit, Chicago, Charleston, W. Va., Milwaukee, St. Louis, Denver, Salt Lake City, Atlanta, Birmingham, Houston, Montreal, Utica

51 YEARS OF SERVICE TO INDUSTRY

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MATERIAL HANDLING EQUIPMENT

Jeffrey Products

Elevators—Conveyors
Portable Loaders
Coal and Ashes Handling Equipment
Skip Hoists
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Sprocket Wheels—Gears
Crushers—Pulverizers
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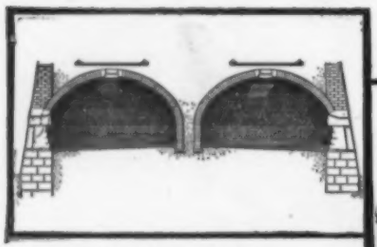
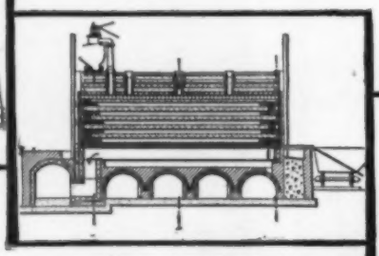
Locomotives
Coal Mine Equipment
Tipple Equipment
Ventilation Fans.

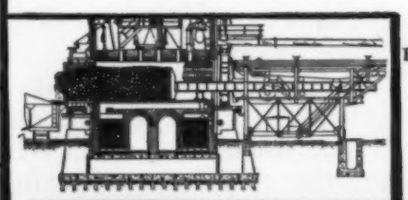
A further step toward *Waste Reduction*



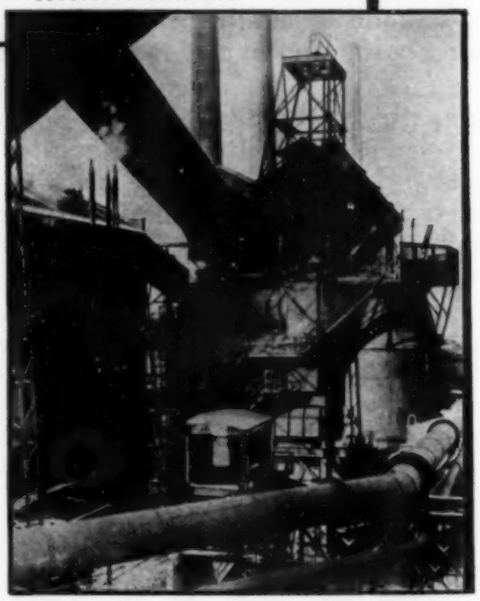
BEEHIVE OVENS



RECUPERATIVE OVEN



REGENERATIVE OVEN



THE Sulzer System of Dry Quenching reduces the waste incident to coke production.

The beehive oven produced coke but wasted all gas and by-products.

The recuperative oven conserved the ammonia, tar and to some extent the oils and coal gas.

The regenerative oven reduced the waste incident to high waste gas temperatures.

A thousand pounds of high pressure steam is delivered per ton of coke cooled by the Sulzer Dry Quenching System—from heat formerly wasted by wet quenching.

The steam production is secured from heat that is entirely wasted by all other methods. It is a further step toward waste reduction.

THE Sulzer System for Quenching coke is simple and dependable. Literature describing this system will be sent to those interested in the advantages of Dry Quenching.

Dry Quenching Equipment Corporation

INTERNATIONAL COMBUSTION BUILDING

200 MADISON AVE. NEW YORK — N.Y.

A SUBSIDIARY OF INTERNATIONAL COMBUSTION ENGINEERING CORPORATION

POWER PLANTS

ONE MILLION K.W. is the ultimate capacity of the Central Station shown at the top of the page. The Laundry, illustrated below, operates a 70 h.p. boiler.

Both plants are equipped with fuel burning apparatus, designed, manufactured and installed by Combustion Engineering Corporation.

There is no sharp dividing line between the responsibilities of the stoker or burner manufacturer, the furnace builder and the boiler maker. Steam Generation is a combined process of heat liberation and heat absorption. The performance of individual elements is secondary to the performance of the combination —*as a unit.* The ultimate goal sought is to produce a dependable supply of steam at minimum cost.

The operation of the Laundry is dependent upon the performance of this 70 h.p. boiler, while thousands of New Yorkers rely upon the East River Station for light, power, transportation and the many material comforts of life which electricity has made available.

The engineering, research and manufacturing facilities of Combustion Engineering Corporation are available to American Industry in raising the standards of Fuel Burning and Steam Generation, throughout the entire range from 70 h.p. to 1,000,000 K.W.—*or beyond.*

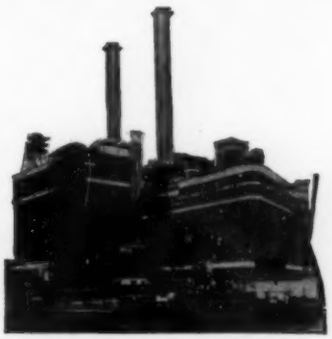
A 70 h. p. boiler serves this laundry

COMBUSTION ENGINEERING CORPORATION

International Combustion Building, 200 Madison Ave., New York

A Subsidiary of

INTERNATIONAL COMBUSTION ENGINEERING CORPORATION



NEW YORK EDISON COMPANY
Thomas E. Murray, Inc.
Designing Engineers

POWER PLANTS ✓
From 70 H. P. to 1,000,000 KW. ult.

BOILERS
From 70 to over 4,000 rated boiler H. P.

PULVERIZED FUEL
Complete systems with Mill capacities from 600 to 60,000 lbs. of coal per hour.

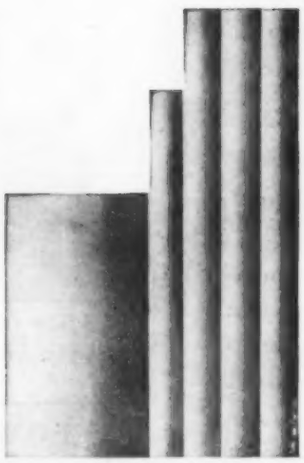
STOKERS
For capacities from 250 to 40,000 lbs. of coal per hour.

WATER COOLED FURNACES
From 90 sq. ft. to 4,132 sq. ft. of water wall surface.

AIR PREHEATERS
From 217 to 66,942 sq. ft. of heating surface.

COMBUSTION ENGINEERING

"Net savings repay added

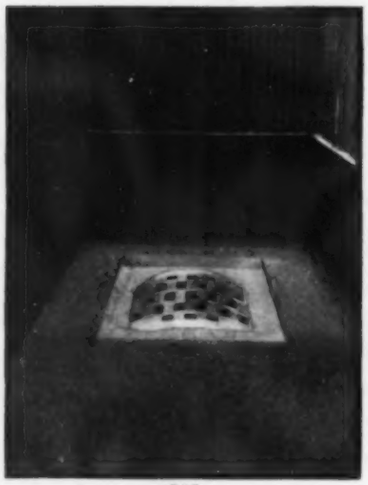


[1]

[1] *Close-up view of one of the fifteen 175 gallon Monel Metal varnish kettles in use at Baer Bros. Co., Stamford, Conn. plant.*

[2] *Radiant heat fires of the type illustrated are used at Baer Bros. Co. plant and are highly satisfactory for use with Monel Metal varnish kettles.*

[3] *Four of the fifteen 175 gallon Monel Metal varnish kettles at Baer Bros. Co., Stamford, Conn. Kettles mfd. by* BECKLEY PERFORATING CO. *of Garwood, New Jersey. Note fume disposal system mfd. by* HEINRICH SOMMER *of Dusseldorf, Germany.*



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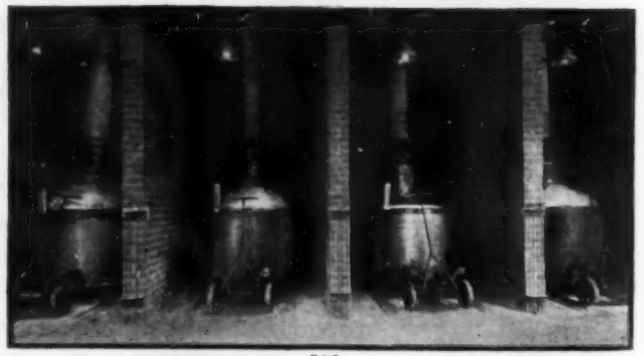


[3]

* Since records of industrial service are subject to varying interpretations, there is a very definite need for an agency that will make an unprejudiced investigation and publish its findings for the benefit of all concerned.

The A. C. Nielsen Co., widely known for its surveys, has recently completed an investigation into the use of Monel Metal varnish kettles by Baer Bros. Co. of Stamford, Conn.

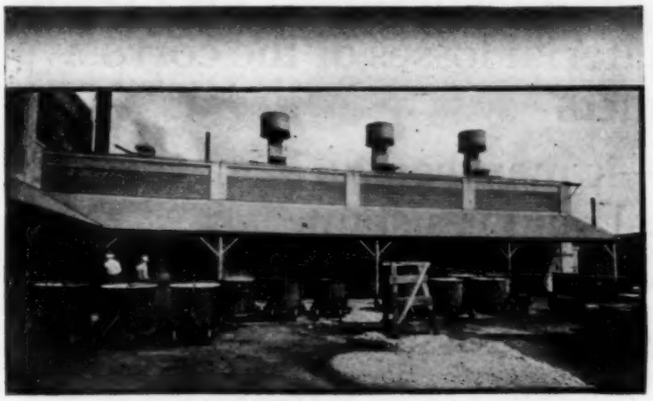
INCO MONEL METAL TRADE

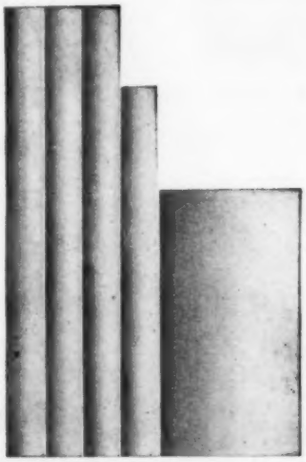
MONEL

THE INTERNATIONAL NICKEL COMPANY, INC.

cost 10 times over" *

MONEL METAL VARNISH KETTLES REDUCE COSTS AND IMPROVE ▲ QUALITY ▲





Exterior view of varnish cook house at new plant of Baer Bros. Co., Stamford, Conn. Fifteen Monel Metal varnish kettles manufactured by BECKLEY PERFORATING CO. *of Garwood, N. J.*

THIS is an advertisement based on the actual facts reported by an organization that investigated the service rendered by Monel Metal varnish kettles in the plant of Baer Bros. Co. of Stamford, Conn.

Here are the facts: Baer Bros. Co. stated that Monel Metal kettles represent an initial investment of 40% more than copper. But Monel Metal in this service "costs on an average, 55.5% less per heat because of the 7 to 1 life ratio of Monel Metal to copper."

Monel Metal produces "a better color of bodied oil"; "lower free-acid content in finished product". It "lowers time lost due to bottom replacements"; "lessens danger of sudden and costly failure"; "affords greater ease of cleaning".

All of these advantages of Monel Metal varnish kettles can be attributed to Monel Metal's possession of a rare combination of basic properties. It will not rust, it resists corrosion, it has great heat-resistance and steel-like strength.

We would welcome the opportunity to give you more information about the manner in which Monel Metal will meet your individual requirements. Why not write today?

This survey is the result of an impartial personal investigation by a Nielsen staff engineer in collaboration with the owner. A responsible executive of the owning company has approved it in writing and the A. C. Nielsen Co., also certifies that the facts and figures are correct to the best of its knowledge and belief. Copies of this survey will be gladly sent on request.

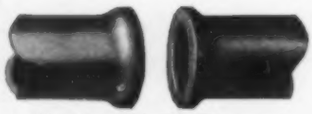
Monel Metal is a technically controlled Nickel-Copper alloy of high Nickel content. It is mined, smelted, refined, rolled and marketed solely by The International Nickel Company, Inc. The name "Monel Metal" is a registered trade mark.

MONEL METAL

INCO MONEL METAL MARK

67 WALL STREET, NEW YORK, N. Y.

For that Acid



Duriron Split Flanged Pipe Ends

Duriron Bulletin Number 148 "Flanged Pipe and Valves," Published November, 1928, Contains full technical data of this Equipment.

Sent on Request.

Duriron Split Flanged Pipe, with flanges for assembly

AN acid line may be a source of continuous expense for maintenance. It may be a dangerous hazard to the structure, and to the worker. It may result in material losses of the corrosive handled.

OR—it may be Duriron, the universal acid resistant.

Duriron pipe, the split flanged type for pressure lines, the bell and spigot type where pressure is but a few pounds, will safely and permanently function with virtually all commercial acids.

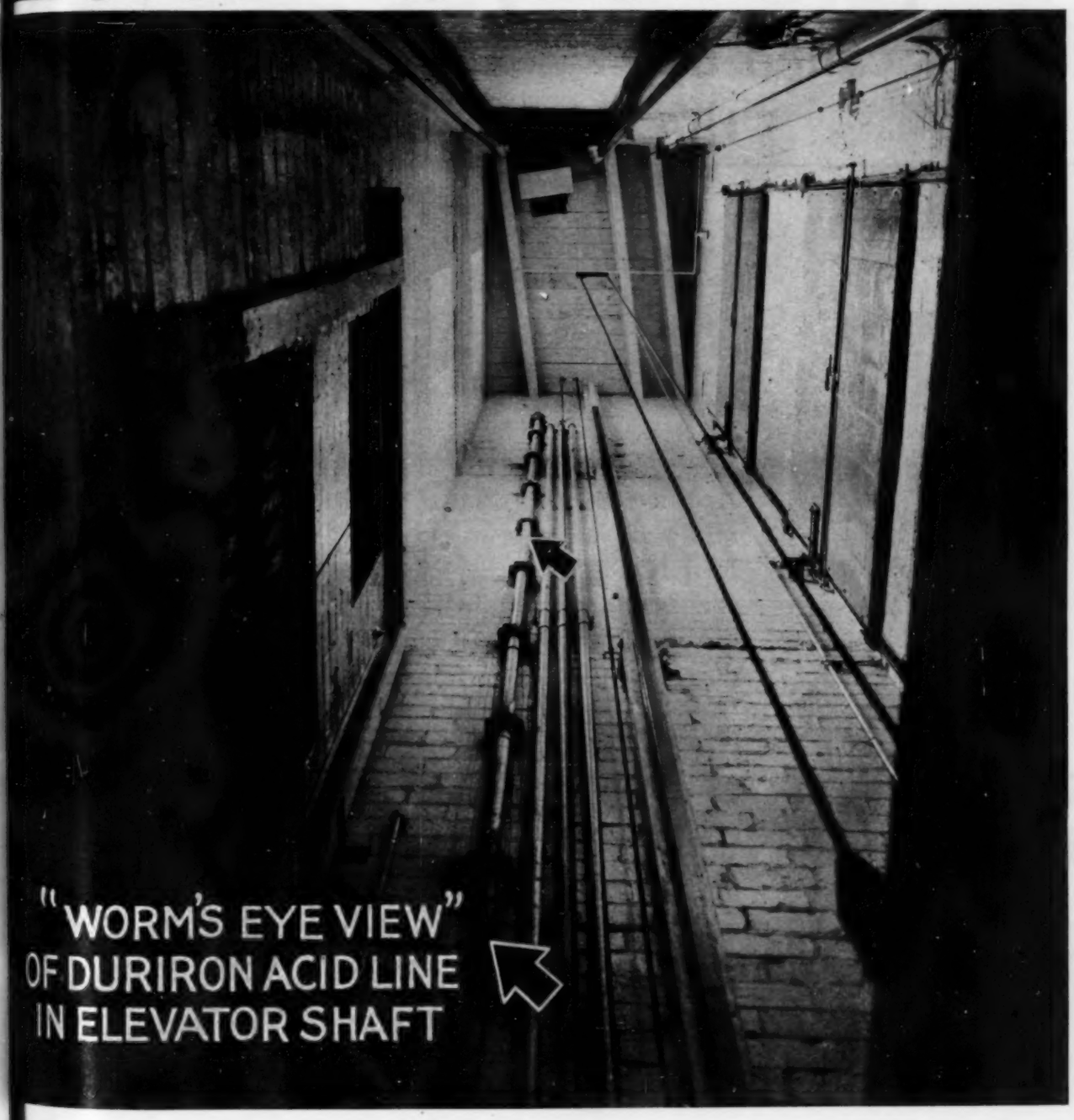
It pays for itself by maintaining a clean plant; by saving acid; by eliminating fire risk and structural damage.

For safety, economy, and assured operation, always install Duriron acid-proof pipe.

The DURIRON

DAYTON

Line~DURIRON



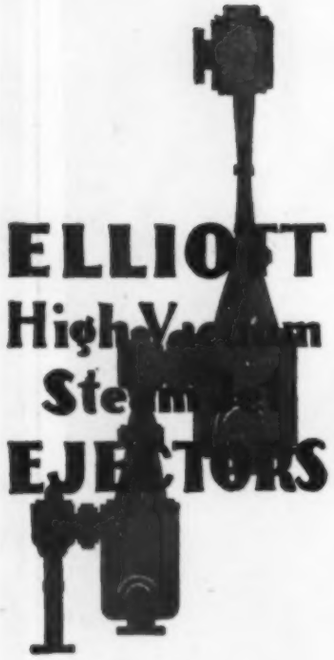
"WORM'S EYE VIEW" OF DURIRON ACID LINE IN ELEVATOR SHAFT

COMPANY

OHIO

They called up the Weather Bureau!

Average temperature yesterday, 54.
Average same date last year, 62.
Average same date for 46 years, 60.
High yesterday, 61 at 1 P. M.; low, 43 at 5 A. M.
Barometer—8 A. M., 30.01; 8 P. M., 30.21.
Humidity—8 A. M., 67; 8 P. M., 76.
Wind—8 A. M. west, velocity 12 miles; 8 A. M. south, velocity 16 miles.
Weather—8 A. M., clear; 8 P. M., clear.



At a well-known industrial plant the engineering staff were testing out a newly installed ELLIOTT Booster Ejector. The reading of the vacuum column immediately became so high that the chief engineer in alarm shut down the ejector and phoned the local Weather Bureau for the official barometer reading.

As is often the case with users in their first experience with ELLIOTT Ejectors, the chief engineer did not realize the high vacuum easily obtainable with this equipment. In plants where it is realized, new economies in process work are common.

What about your processes? Would high vacuum, as supplied by ELLIOTT Ejectors, cut your costs? ELLIOTT engineers are ready to give you all the facts.

ELLIOTT COMPANY

PITTSBURGH, PA.

General Sales Offices **JEANNETTE, PA.**

District Offices in principal cities

0-826

Elliott Power Equipment includes engines and turbines, generators and electrical machinery, condensers, deaerators, heaters, centrifugal blowers, and accessory equipment.

Protection and Service!

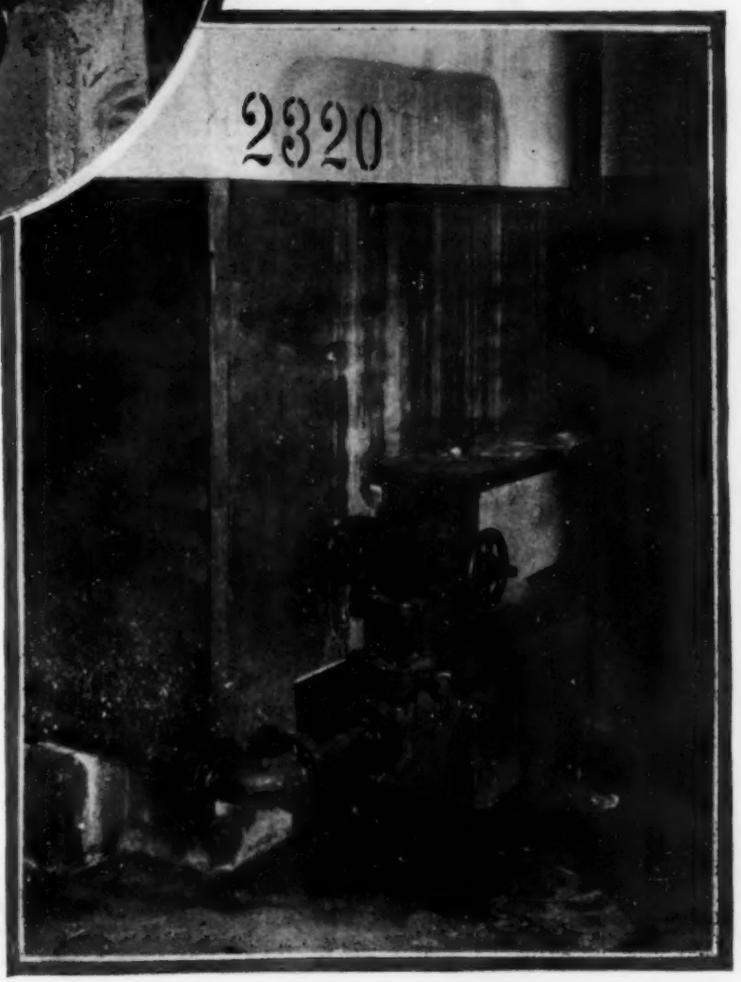
RESISTO

Lead Lined — Tin Lined — Hard Lead Alloy

Pipe	Valves
Fittings	Pumps
Tanks	Castings

Special Apparatus, etc.

For Chemical Plants, Bleacheries, Refineries, Rayon Plants, Leaching Operations, Dyes, etc.



When planning new acid lines or replacing other equipment, specify

RESISTO

That Resisto Acid Equipment has been chosen for important installations by large companies is sufficient endorsement that it is built for efficient service. Write us for details and service data.

Complete manufacturing, engineering and installation service is available from our organization.

RESISTO PIPE & VALVE COMPANY

262 Bridge St., E. Cambridge, Mass. 1133 Broadway, New York

UNITED TUBOND *withstands* vibration

WHEN you install pipe for handling acids, you naturally make sure that it is corrosion-proof—but what about the VIBRATION to which a vertical pipe is subjected in pulsating pumping service? Will cracks develop? The answer is "No" if "United Tubond" pipe is used. Here is lead-lined pipe which is more than merely corrosion-proof. In "United Tubond" the lead is solidly, rigidly and everlastingly joined to the wrought iron or steel by a special process and this pipe not only withstands vibration but shock and pressure as well.

"UNITED LINED" EQUIPMENT

includes not only "United Tubond" pipe but also lead-lined fittings, valves and tanks. Under the "United" trade mark are also sold hard-lead fittings, valves, cocks and pumps.

"United" installations are now in satisfactory use, eliminating replacements and lasting *years* where other equipment lasted *months* in practically every process industry—cellulose, dye-stuffs, explosives, chemicals, lime, food products, petroleum, rubber, etc., etc. Let us send you actual service reports on installation in your industry.

and

UNITED TUBOND DEFIES:

Shock
Creeping
Leakage
Expansion
Contraction
and
Corrosion

A Sure Saving Use "UNITED" PRODUCTS

Chemical Lead Lined Pipe and Fittings

for the handling of Dilute Sulphuric, Sulphurous and other acids, mine and salt water, etc.

Tin-Lined, Brass-Lined and Copper-Lined Pipe and Fittings.

Acid Valves

Chemical Lead and Tin Covered Pipe and Fittings.

Hard Lead Centrifugal Acid Pumps

UNITED LEAD CO.

A Subsidiary of

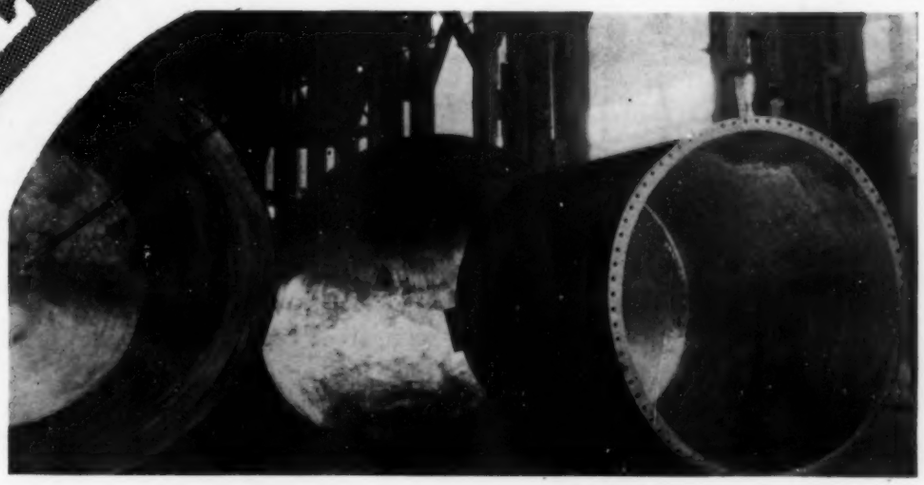
NATIONAL

111 Broadway, New York City

FOR CORROSION RESISTANCE *PLUS*

HOMOGENEOUS LEAD LINED

Two 104-inch diameter homogeneous lead-lined tanks and one 72-inch washer.



NO matter how large the pressure still, the vacuum evaporator, or container, wherever corrosive liquors are handled, the lead lining of Homogeneous Lead-Lined Equipment will not come loose.

Our improved method of casting the lining of chemical lead affords a dense, flawless, protective lining for the steel. And—the bond is as strong as the lead itself. Vacuum or intensive vibration cannot force it loose. Temperatures cannot affect the bond until the melting point of lead is reached.

Each unit is thoroughly tested in our shops before shipment. Shutdowns that would hold up production are eliminated from the start. Write for full particulars, or let us give you quotations on stock sizes of the units you require.

Partial List of Products:

VACUUM EVAPORATORS
VACUUM TANKS
STEAM JACKETED KETTLES
ACID EGGS
CAR TANKS
DIGESTERS
AUTOCLAVES
AGITATORS

LEAD COMPANY

Sole Agents for the Chemical Equipment Mfg. Co.

FOR CORROSION RESISTANCE *PLUS*

Dewatering in the Hardinge Clarifier and Thickener

A few of the users of this device who testify to its ease of operation, saving of time and satisfactory results, are

Pasadena Sewage Plant.
Clarifying Activated Sludge.

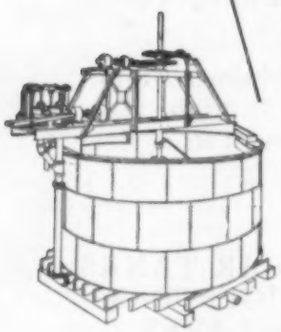
Schmidt & Ault Paper Co.
Removing Pulp from White Water.

Edison Storage Battery Co.
Removing Solids from waste water to prevent pollution.

Vanadium Corporation.
Thickening Vanadium Sludge.

The particularly valuable feature of the Hardinge Clarifier is that the solids are moved from the periphery of the tank to the center in 1¼ revolutions.

This positive action of the Spiral Scraper makes it possible to operate the machine at a very slow speed. Solids are removed from the liquid as rapidly as they are settled, and without reabsorption.

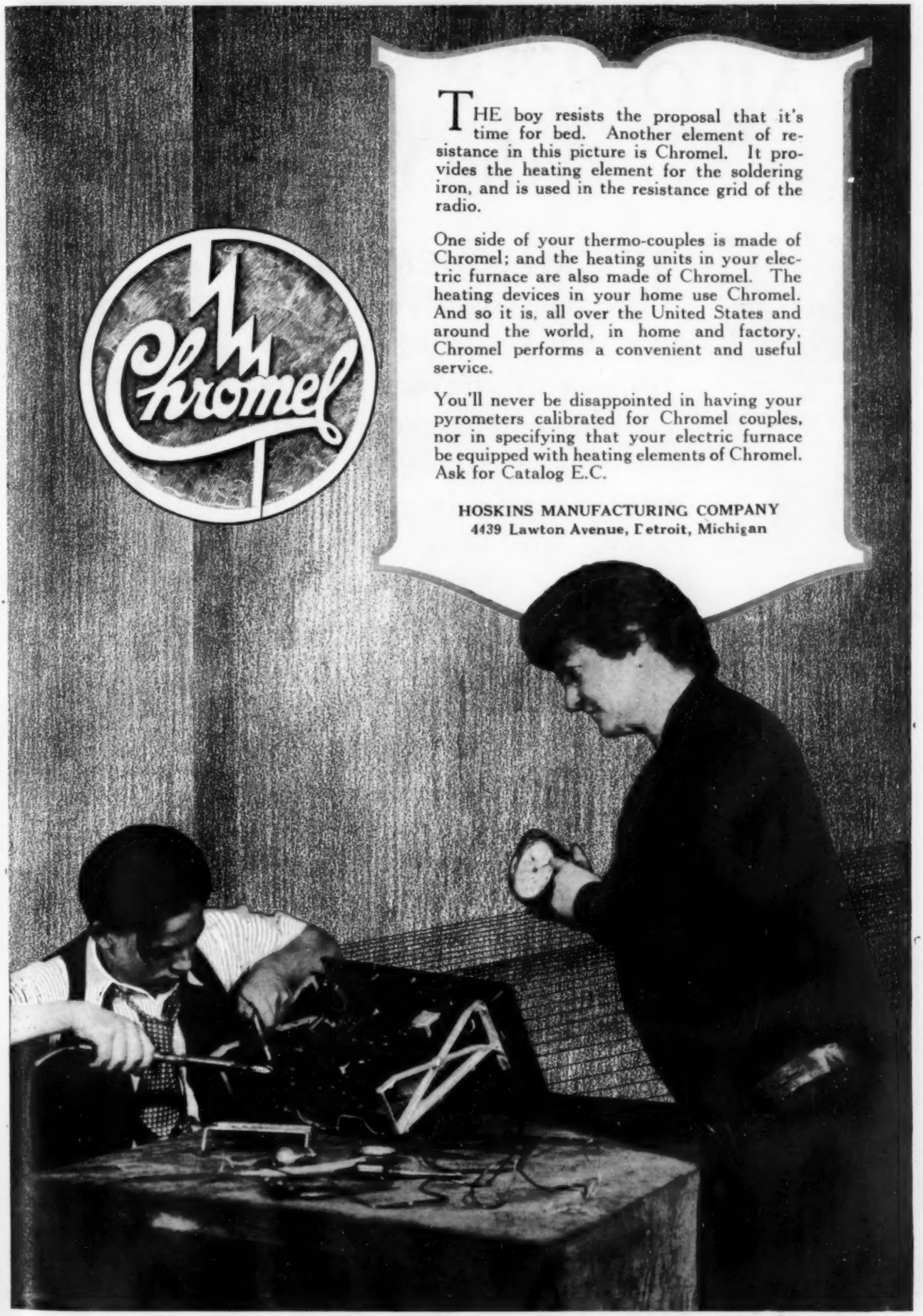


Our Bulletin No. 31 describes the construction and operation of this machine. Write for a copy.

HARDINGE COMPANY
YORK, PENNSYLVANIA
BRANCH OFFICES
NEW YORK, N.Y.—120 BROADWAY
SALT LAKE CITY UTAH—CONTINENTAL BANK BLDG.

Ruggles-Coles Dryers, Conical Ball, Pebble and Rod Mills, Thickeners, Clarifiers

HARDINGE



THE boy resists the proposal that it's time for bed. Another element of resistance in this picture is Chromel. It provides the heating element for the soldering iron, and is used in the resistance grid of the radio.

One side of your thermo-couples is made of Chromel; and the heating units in your electric furnace are also made of Chromel. The heating devices in your home use Chromel. And so it is, all over the United States and around the world, in home and factory, Chromel performs a convenient and useful service.

You'll never be disappointed in having your pyrometers calibrated for Chromel couples, nor in specifying that your electric furnace be equipped with heating elements of Chromel. Ask for Catalog E.C.

HOSKINS MANUFACTURING COMPANY
4439 Lawton Avenue, Detroit, Michigan

All Over the WORLD

QUEENS FERRY, ENGLAND

BARCELONA, SPAIN.

BUKAREST, ROUMANIA.

ISLAND OF BORNEO.

THE term, **CHEMICO,** has become synonymous with successful designing and constructing of chemical plants. The plants illustrated represent a few of a number built in other countries by our organization. Most of our operations are in the United States and Canada. The same expert engineering is applied regardless of the location.

Our own engineers supervise the construction of all **CHEMICO** plants. It is this supervision plus centralized responsibility that enables us to deliver efficiently operating plants to the owners.

HONOLULU, HAWAII.

HALIFAX, NOVA SCOTIA.

TAMPICO, MEXICO.

BUENOS AIRES, ARGENTINA.

CHEMICAL PLANTS → **CHEMICO** ← *CHEMICAL PROCESSES*

CHEMICAL CONSTRUCTION CO.

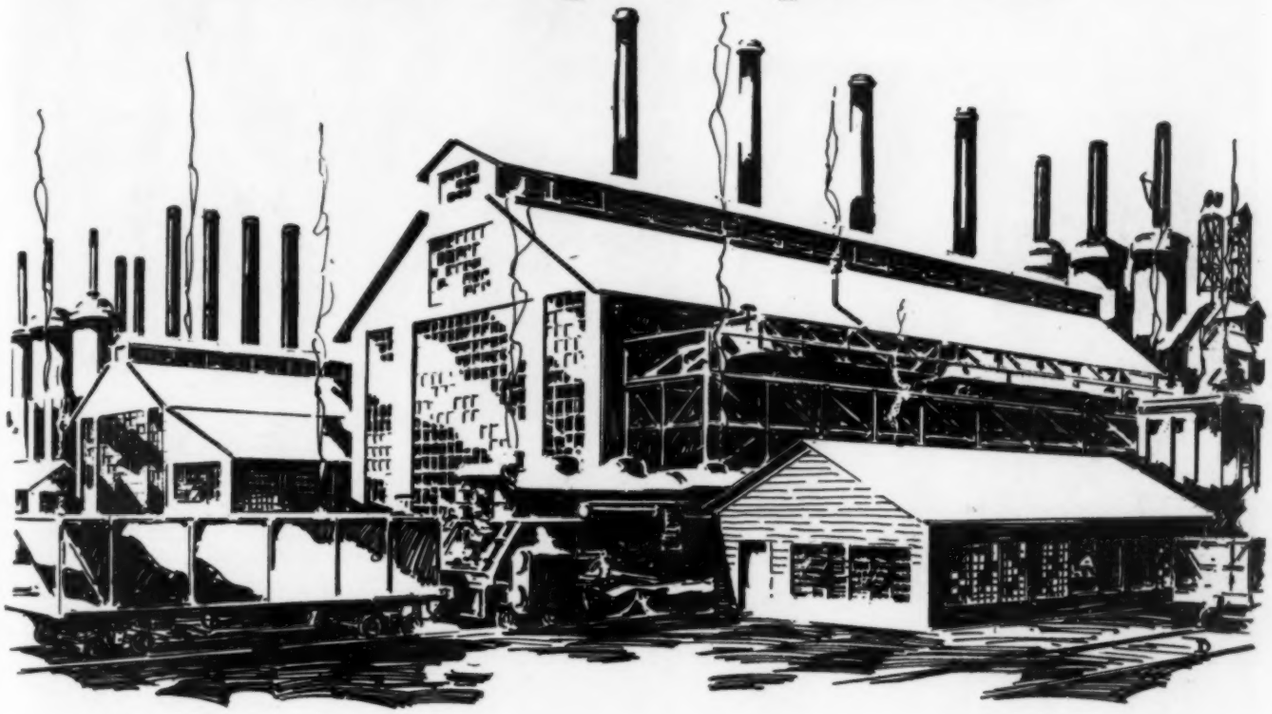
ENGINEERS AND ERECTORS

Plants for the Manufacture and Recovery of Acids, Heavy Chemicals, Fertilizers, etc.

MAIN OFFICE, CHARLOTTE, N. C.

New York Office: 50 E. 42d Street

PULVERIZED-COAL
in Metallurgical Operations



THE use of Pulverized-Coal for metallurgical furnaces is increasing. Pulverized-Coal is now used successfully for firing heating, reheating, puddling, continuous-heating, annealing, malleable-melting, and other types of furnaces.

Among the advantages obtained by its use are, reduction in fuel requirements, increased capacity, and hence lower cost of production.

Fuller Lehigh Pulverized-Coal Equipment, widely used in boiler and cement plants, has proven equally reliable and efficient when applied to metallurgical furnaces.

Fuller Lehigh equipment is adaptable to practically every metallurgical requirement.

Would you like copies of reprints of trade journal articles on Fuller Lehigh Installations in the metallurgical field?

FULLER LEHIGH COMPANY, FULLERTON, PENNA.~ *A Babcock & Wilcox Organization*

FULLER LEHIGH

PULVERIZED-COAL EQUIPMENT ~ WATER-COOLED FURNACE WALLS

SWENSON

FOAMING *Niagara*

Without Entrainment

The entrainment of valuable products during evaporation and subsequent loss to sewer is always a source of heavy loss to the manufacturer. The Swenson Forced Circulation Evaporator not only evaporates the average liquor without loss from a practical standpoint, but is particularly well adapted to handling foaming and viscous liquors which would give the most trouble in the natural circulation evaporator. The boiling liquor is discharged from the tube at a high velocity against the parabolic deflector. The vapors are discharged thru a curtain of liquor whose motion is rapidly downward. This combination prevents entrainment in the ordinary sense and at the same time beats down any foam that may be formed in the body. Our Evaporator Experiment Station has studied the entrainment problem in our semiplant scale evaporator and the results of these tests are available for application to your problems. Careful material balances kept by our customers together with condensate analyses give ample evidence that the forced circulation evaporator provides a cure for entrainment evils.

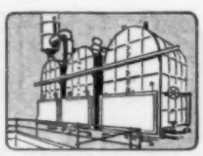
Send for Bulletin S-128

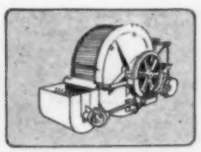
SWENSON EVAPORATOR COMPANY

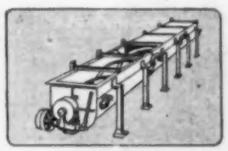
(Subsidiary of Whiting Corp.) 15669 Lathrop Ave., Harvey, Ill. (Chicago Suburb)

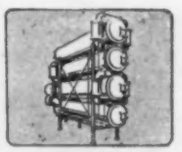
BASKET TYPE EVAPORATORS

VERTICAL TYPE EVAPORATORS

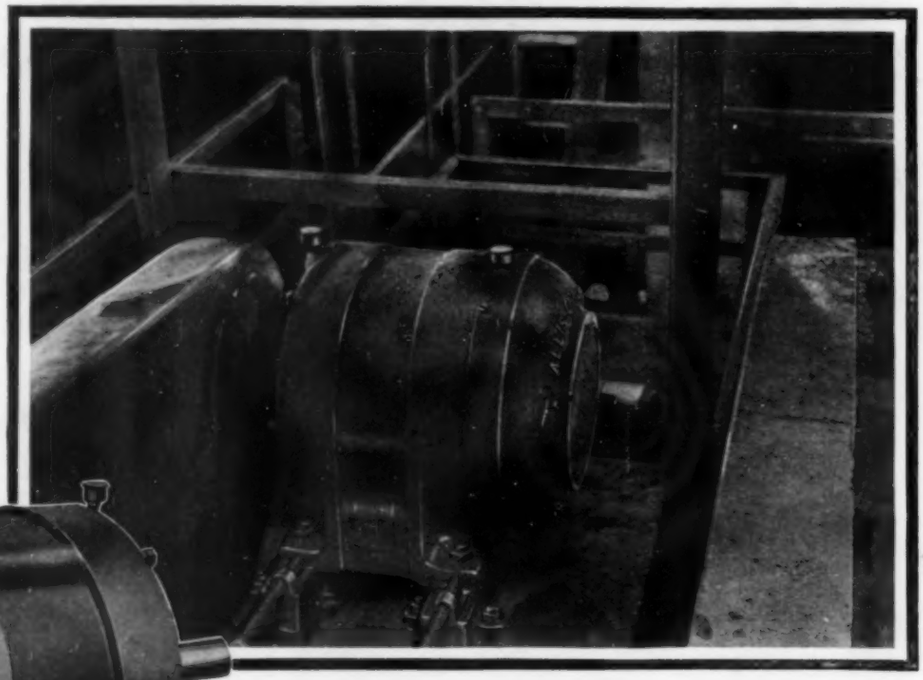

HORIZONTAL TUBE EVAPORATORS


ROTARY VACUUM FILTERS


CONTINUOUS CRYSTALLIZERS


YARYAN EVAPORATORS

Dirt cannot enter



Allis-Chalmers Type ARZ, totally enclosed fan-cooled motor driving sand elevator in a large steel foundry.

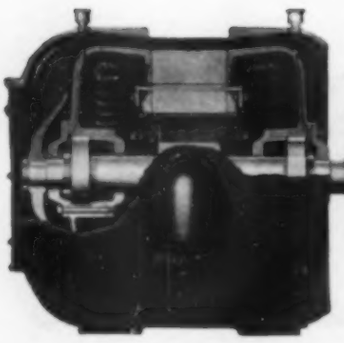
In spite of the accumulation of dirt on and around this Allis-Chalmers motor the inside is as clean as the day it left the factory.

-this totally enclosed fan-cooled motor

This Allis-Chalmers totally enclosed fan cooled motor is protected permanently against damage under such operating conditions. The stator windings and rotor, and all parts subject to destruction, are sealed against the entrance of dirt. An open type motor in such a location is not the economical selection in view of the availability of the totally enclosed fan-cooled type.

ALLIS-CHALMERS MFG. COMPANY, MILWAUKEE, WIS.

District Offices in all Principal Cities



ALLIS-CHALMERS

Totally Enclosed Fan-cooled **MOTORS**

Chemistry

the positive control of modern industrial processes

CHEMIST, chemical engineer and manufacturer of chemical process or allied equipment to-day face a brighter future than ever before. Industry in general, process industries especially, realize that Chemistry controls their very existence, enhancing the value and stimulating the search for methods, materials and machinery.

Here, then, are conditions that demand just such opportunities as are presented by the National Exposition of Chemical Industries.

There assembled, the chemist, engineer and executive find the leading manufacturers in attendance to show and explain their newest products. Producers of materials, equipment, instruments and tools who welcome inspection and comparison, take this opportunity to meet their potential customers face to face.

Conversely, these same potential customers—men responsible for results in factory, mill and laboratory—welcome the opportunity to view the exhibits, to learn the facts at first hand, to discuss their problems with specialists.

More than 67,000 eager, progressive leaders from all over the world visited the exhibition last year. A still larger attendance is forecast for the coming exposition. Whether you are a user, buyer or seller, the Exposition of Chemical Industries at Grand Central Palace, New York, during the week of May 6, 1929 is an event of major importance to you.

To promote your business, make the most of it.

3112

12th EXPOSITION OF CHEMICAL INDUSTRIES

Week of May 6, 1929

GRAND CENTRAL PALACE

NEW YORK

Management International Exposition Co. Largest Industrial Exposition Organization in the World

Staggering manufacturing Wastes

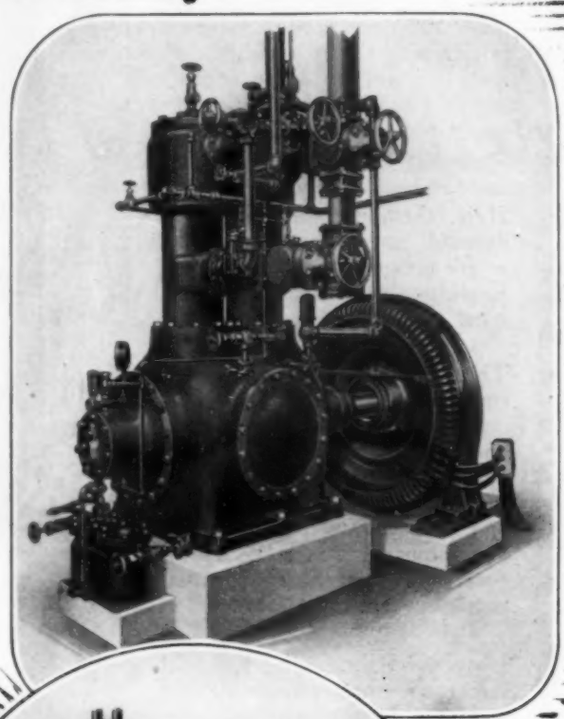
~ are banished by YORK Mechanical Refrigeration!

Chemistry has quickened the march of industry—created new industries, salvaged vast wastes, made industry more profitable and made life safer, easier, altogether more livable.

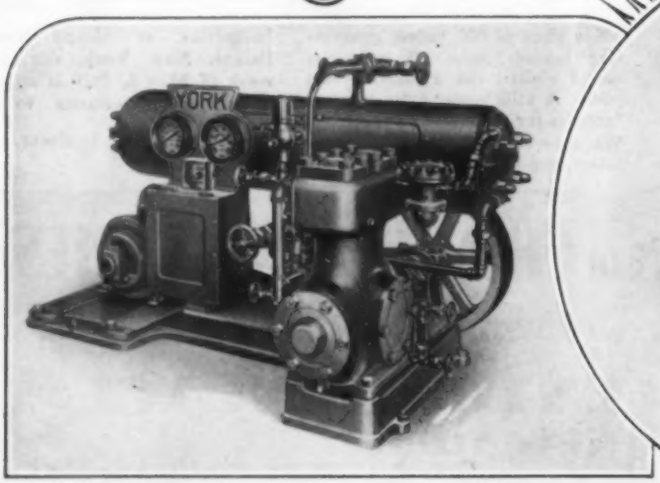
Some credit, however, must be given to York Mechanical Refrigeration.

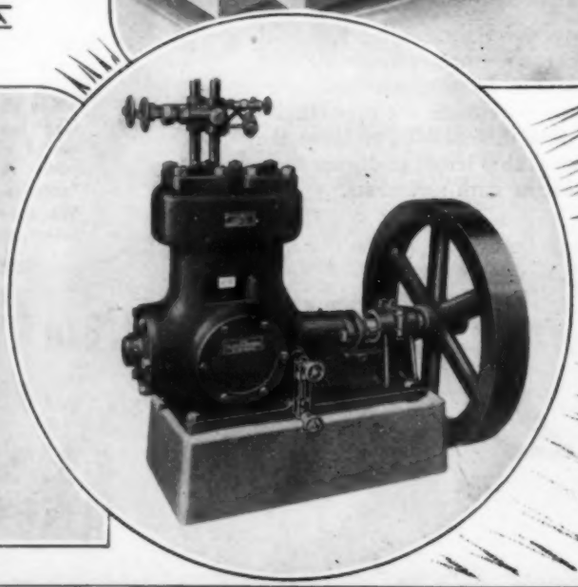
York's development of efficient, economical, dependable Refrigeration for industry has made the seemingly impossible easy to accomplish. It has banished staggering manufacturing wastes. It has made distribution and safe-keeping of highly perishable products a simple matter.

Your particular refrigeration problems can be solved—without obligation—by York Engineers, backed by the experience and facilities of the world's largest manufacturer of Refrigerating ma chinery for every industrial and com mercial need.



YORK
ICE MACHINERY CORPORATION
YORK Y PENNA





Make This Simple "DESK-T
for demonstrating the
quick-slaking property
Speed Pebble
newspaper on desk. Place a
of lime in the center.
small amount of water (pre-
warm) over the lumps.
not to stand too near the
the test as the speed
which it slakes frequently
the lumps to pop.
VILLE CEMENT CO., Incor

DOES THIS BELONG TO *YOU*?

SEVERAL weeks ago we mailed to a large number of chemical manufacturers three-ounce sample jars of Speed Pebble Lime with which to test the unusually quick-slaking property of this new product.

A number of the jars, however, were returned to us undelivered because the labels were damaged in transit.

So if you have not received your sample, let us know and we shall send you the jar we intended you to have.

Judging from the comments we have received, these samples have proven of real interest and value to many manufacturers. For in addition to exceptionally rapid slaking, Speed Pebble Lime maintains the high standard of purity, uniformity and efficiency that have characterized all Speed Limes for over half a century. Reduced size of lumps. Keeps better in storage. Average calcium oxide content 95%.

LOUISVILLE CEMENT COMPANY, *Incorporated*, LOUISVILLE, KENTUCKY

SPEED LIME

CHEMICAL SPEED LIME

CHEMICAL SPEED HYDRATED LIME

Please Note!

Speed Chemical Hydrated Lime is now packed in 50-pound, *3-ply, air-tight, valve bags* to facilitate handling and for thorough protection of the product in transit. Speed Chemical Lime (lump and pebble forms) shipped in paper-lined, wood barrels, in waterproof jute bags or in bulk.

Maintaining 27 to 28" vacuum on fatty acid stills

The above is but typical service rendered by ROOTS Rotary Vacuum Pumps. It is but one of many types of applications in the "industries of process." It illustrates, however, the high vacuum efficiency that can be expected with Roots Vacuum Pumps with low expenditure for power and upkeep.

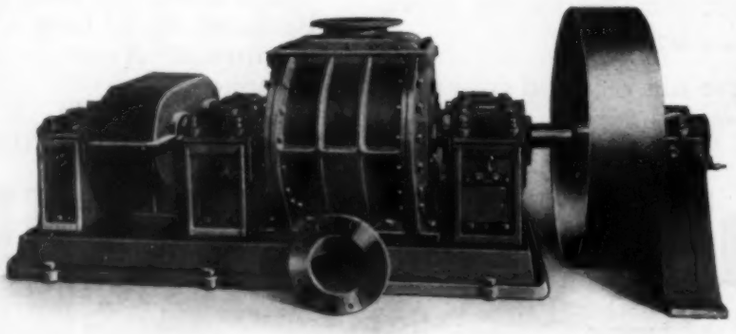
Here again it is the simplicity of the Roots principle of design that makes for the highest service efficiency. The suction is created by the action of two revolving impellers, entrapping a positive volume of air at each revolution.

Where the problem is one of discharging water against a head in addition to pulling a vacuum, Roots Pumps are built with a special straight line type of impeller.

These pumps are built in a variety of sizes. A popular application is at paper mills for suction boxes and vacuum rolls. The smaller sizes are doing superior service for removing air and condensate from steam heating systems, handling natural gas, in vacuum filtration and evaporation systems, etc.

It is impossible to list all possible applications for which Roots Rotary Vacuum Pumps (due to their ability to handle large volume without excessive size, low first cost, practically zero maintenance cost, and power saving compared with reciprocating pumps) are adapted. The Roots Engineering Staff will assist you in plans for application of vacuum of 28" or less.

ROOTS



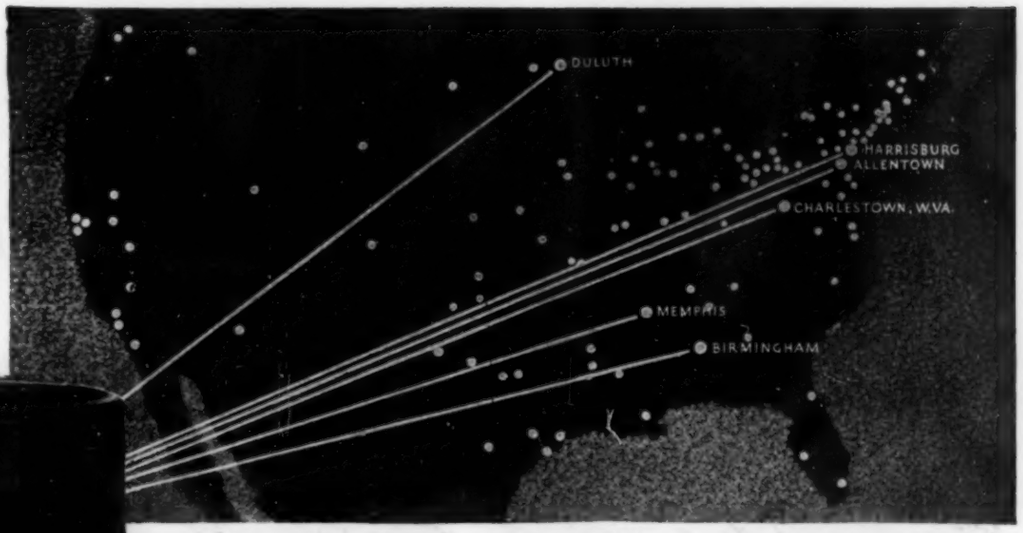
The P. H. & F. M. ROOTS CO.

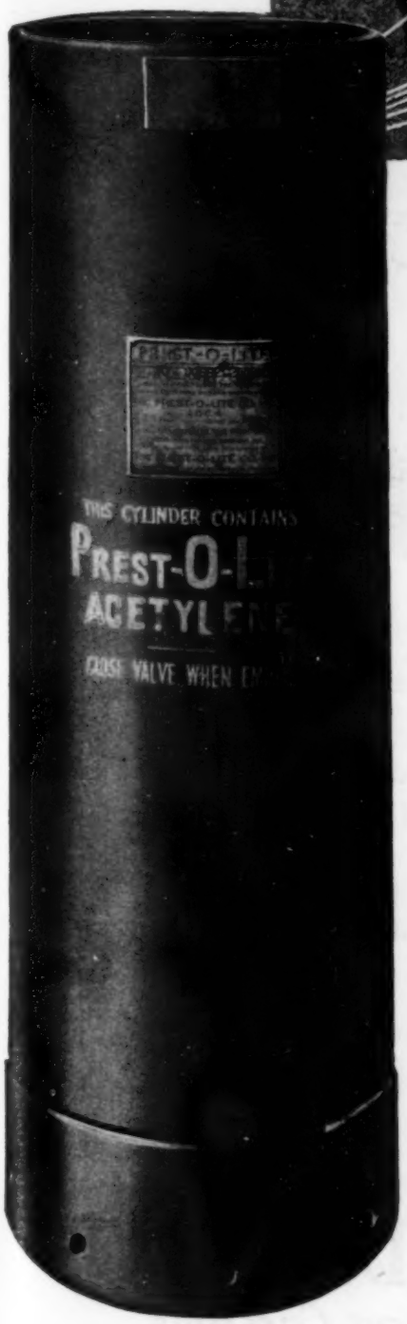
CHICAGO
Peoples Gas Building

CONNERSVILLE, INDIANA

NEW YORK
120 Liberty Street

Originators of the Double Impeller Rotary Principle





Six new reasons for buying

Prest-O-Lite

DISSOLVED ACETYLENE

THE FACT that Prest-O-Lite could be readily obtained direct from plants or warehouses in most of the industrial centers of the country has been one reason for its tremendous success.

But the nation-wide demand has been steadily growing. To keep pace with this increased business, six new manufacturing plants have been placed in operation during the past year.

And now, with a total of 35 plants and 100 warehouses, Prest-O-Lite is equipped to render industry even greater service.

THE PREST-O-LITE COMPANY, INC.

Unit of Union Carbide UCC *and Carbon Corporation*

GENERAL OFFICES: Carbide and Carbon Building
30 East 42d Street, New York

To get perfectly balanced ALLOY CASTINGS— *specify* SWEETALOYS!

SWEETALOY CASTINGS are balanced in composition to resist corrosion and high temperatures

Difficult corrosion-resisting castings, made to withstand hydrostatic pressure, such as illustrated here, require specialized skill at every step in the foundry—melting, moulding, pouring, and cleaning.

Our line of SWEETALOYS includes the alloy that will successfully resist the corrosive condition you are contending with.

SWEETALOY CASTINGS

(Produced in co-operation with patentees)

STAINLESS IRON
CHROME IRON
NICKEL CHROME IRON
DELHI RUSTLESS IRON
REZISTAL
ATHA 2600
MONEL METAL
MOND 70
PURE NICKEL

If you will send us specifications of your requirements, we will be glad to recommend the SWEETALOY for your castings. Write today for a copy of our FREE ILLUSTRATED DESCRIPTIVE CHART. It's valuable to you!

WM J. SWEET FOUNDRY CO.

Non-Corrosive and Heat-Resisting Castings for the Process Industries

IRVINGTON N. J.

FANSTEEL TANTALUM

Research opens up many new uses for this phenomenal metal . . . . . .

Research throughout industry, the past year records the development of many new uses for Tantalum. The Fansteel Laboratories, too, have been busy evolving new methods of treating the raw metal.

....now Tantalum is available in any requisite hardness for deep drawing.

....it can be electrolytically colored in many iridescent colors.

....a simple method of spot welding Tantalum to itself or other metals will be found along the line of progress.

....seamless tubing of this metal has been fabricated—a development which opens the way for the use of Tantalum in coils for stills and pipe linings.

....new laboratory instruments and utensils have been developed.

And all this, and more, in the short period of a few months—for Tantalum in commercial form has been available for only slightly more than two years.

The demand for Tantalum while logical, has been spectacular, for manufacturers have quickly seized on this highly prized metal to meet the peculiar needs of their products.

You, too, through investigation, can find the use of Tantalum profitable. Our research engineers will gladly work with yours. If you prefer to experiment with this metal, let us send you a small sample sheet. There is no obligation.

FANSTEEL PRODUCTS COMPANY, Inc.

FACTORY, NORTH CHICAGO, ILLINOIS

Eastern District Office, 50 Church St., New York City

Characteristics of commercial tantalum

Technical characteristics

Atomic number	73
Atomic weight	181.5
Density	16.6
Atomic volume	10.9
Tensile strength, lb. sq. in.	130,000
Compressibility per kg. per sq. cm.	0.50×10^{-6}
Brinell hardness	45.9
Scleroscope hardness	10
Young's modulus of elasticity kg. per sq. mm.	19,000
Melting point, degrees C	2,770
Specific heat cal. per gm. per degree	0.0365
Linear coefficient of expansion per degree C	7.9×10^{-6}
Thermal cond., in cal. per c. c.	0.130
Heat of combustion, cal. per gm.	1,147
Heat of combustion, cal. per gm. molecule to oxide	301,500
Temp. coefficient of resistance	0.00335
Elec. resistance microhm per c. c. at 25° annealed	14.6
Magnetic susceptibility, X 10^6	0.8
Electrochem. equiv., mg. per coulomb	0.3762
Refractive index	2.05
Thermoelectric e. m. f. against copper, microvolts per degree	4.1

Chemical properties

The most characteristic chemical property of Tantalum is its unusual resistance to chemical corrosion. It is not attacked by hydrochloric or nitric acids or by *aqua regia*, either hot or cold. It is not attacked by dilute sulfuric acid at ordinary or more elevated temperatures, but appears to be slowly attacked by boiling, concentrated sulfuric acid. Solutions of caustic alkalies do not attack the metal easily. Hydrofluoric acid seems to be the only chemical agent which will attack it, and in the case of very pure metal and very pure hydrofluoric acid the action is very slow. A mixture of hydrofluoric and nitric acids will attack the metal with avidity, causing it to go into solution as Tantalum fluoride.

If Tantalum is heated in the air, the surface becomes blue at a temperature of about 400° C., and at a somewhat higher temperature, nearly black. Above a dull red heat the white oxide is produced and the metal gradually burns. This metal combines with avidity with hydrogen, oxygen, or nitrogen. It will take up 740 times its own volume of hydrogen, producing a very coarse-grained, brittle product.

Tantalum containing dissolved gases will be harder than the pure metal, and if their quantity is appreciable the metal may even be brittle—so all annealing or heating operations with Tantalum must be carried out in a vacuum. Solutions of chlorine or the gas itself are without any action on the metal. Tantalum is not affected by any of the chemicals or antiseptics used in dentistry or surgery.

Corrosion data

Below is corrosion data on Tantalum as far as has been actually determined as a guide in determining its suitability for particular uses. Tantalum, in so far as its properties can be compared with other materials, is more resistant to corrosion than any known metal or alloy. In the table, the words opposite the corrosive agent have the following meanings:

EXCELLENT: Resistance to corrosion of such a degree in laboratory and service tests that a long life of years is obtained.

GOOD: Resistance to corrosion of such a degree in laboratory and service tests that commercially long life is obtained.

FAIR: Resistance to corrosion of such a degree in laboratory and service tests that the material may be used when cost is not a consideration.

POOR: Resistance to corrosion of such a degree in laboratory and service tests that the material is useless.

This table takes the form of the table on corrosion worked out by the committee of the Society for Testing Materials under the chairmanship of Jerome Strauss. The ratings given are conservative and it is recommended that the Tantalum be sampled by the user for special processes.

Form of Material Wrought—Sheet, Wire or Bar.

Sulfuric Acid	Dilute	Excellent
	Concentrated and below boiling point	Excellent
Nitric Acid	Very Dilute	Excellent
	Concentrated	Excellent
Hydrochloric Acid	Dilute	Excellent
	Concentrated	Excellent
Aqua Regia		Excellent
Hydrofluoric Acid		Poor
Hydrofluoric and Concentrated Nitric Mixed		Poor
Acetic Acid	10% Solution	Excellent
	Concentrated (Glacial)	Excellent
Formic Acid	12% Solution	Excellent
	50% Solution	Excellent
Oxalic Acid	10% Solution	Excellent
Phosphoric Acid	10% Solution	Excellent
	85% Solution	Excellent
Carbolic Acid	5% Solution	Excellent
Citric Acid Solution		Excellent
Tannic Acid	15% Solution	Excellent
Sodium Acetate	20% Solution	Excellent
Iodine Solution	10% Solution	Excellent
Chlorine Solution		Excellent
Sodium Hydroxide	Dilute Solution	Good
	Hot Concentrated	Poor
Potassium Hydroxide	10% Solution	Excellent
Ammonium Hydroxide		Excellent
Sea Water		Excellent
Sea Air		Excellent
Moist Atmosphere		Excellent
Moist Sulphurous Atmosphere		Excellent
Mine Waters		Excellent
Gases Containing Carbon Monoxide		Excellent

FURTHER INFORMATION IS AVAILABLE ON REQUEST

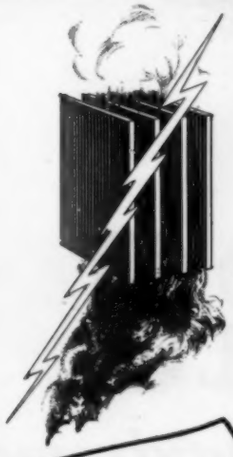
FANSTEEL PRODUCTS COMPANY, Inc.
NORTH CHICAGO, ILLINOIS

—Printed in U.S.A

Electrical Precipitation

FUMES SOOT ASH ACID DUSTS MIST TAR FOG

COTTRELL PROCESSES



Electrical Precipitation
for

- Gas Detarring — Water Gas, Coke Oven Gas
- Powdered Fuel Boiler Plants — Flue Ash Removal
- Blast Furnace Gas Cleaning — Primary—for Stoves and Boilers; Secondary—for Engines, Coke Ovens and Metallurgical Operations
- Sulphuric Acid — Recovery from Production Operations; Purification
- Roaster Gas Cleaning — Removal of Fyrites and Zinc Dust in Acid Manufacture
- Non-Ferrous Metal Treatments — Recovery of Copper, Lead, Zinc Tin, Gold, Silver, Mercury, etc.
- Carbon and Lamp Black Recovery
- Asphalt Products Recovery
- Paper and Pulp Mills — Sulphate and Soda Liquor Recovery
- Food Products Recovery
- Air Cleaning — Dust Removal or Recovery
- Miscellaneous Acid Recovery

For Detarring Gas

THE closing month of 1928 finds Electrical Precipitation more firmly established than ever before as the most effective and economical means of Detarring Manufactured Gas.

Its acceptance is based upon actual achievements—not only with carburetted water gas but also with coke oven gas as produced with two of the well-known types of ovens.

The performance records of Electrical Precipitation in Detarring Gas justify its place in your budget of recommended improvements for 1929.

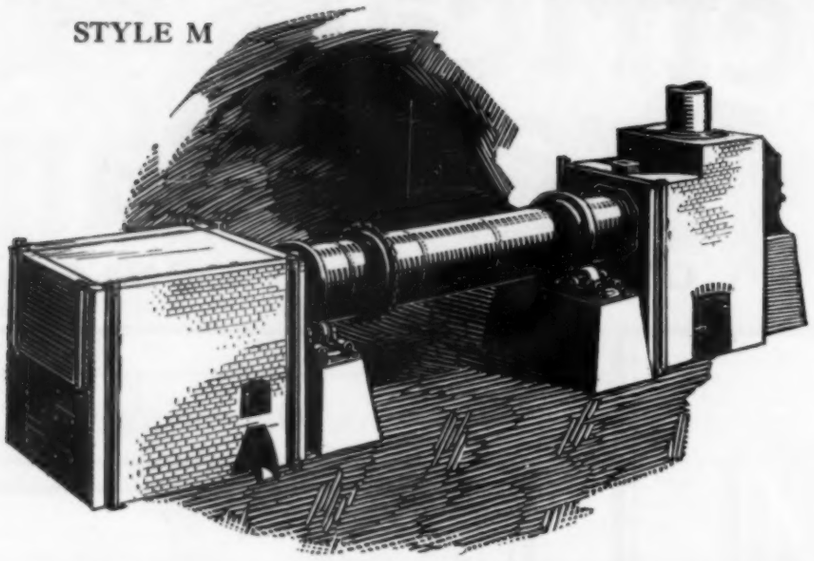
See Bulletin 202 for details.

Chicago Office:
343 S. Dearborn Street

Research Corporation
25 West 43rd Street, New York, U. S. A.

Plant and Laboratory:
Bound Brook, N. J.

STYLE M



DRYERS

13 Standard Types for Many Requirements

By
ANY STANDARD
Bartlett-Snow
COAL ASH AND ORE HANDLING EQUIPMENT
Bartlett-Snow Skip Hoists are proportioned for the brutal necessities of bulk material handling. Their resistance to wear and disorder is almost individual.

Style "M" Dryer is simple. Substantially it is a long revolving cylinder which has a furnace at one end. The wet material in passing through it is repeatedly cascaded by a series of lifting flights. Through this showered material the hot gases pass in a counter direction. The process is continuous.

Powder mills use many Style "M" Dryers for nitrate of soda. Other plants employ them for sand, stone, ores, clay, fertilizers and chemical substances. Their advantage lies in their moderate first cost and low fuel consumption. Their upkeep is a trifling expense.

A line asking for Bulletin 51 will bring you the story of all Bartlett-Snow Dryers.

THE C. O. BARTLETT & SNOW CO.
6204 Harvard Ave. Cleveland, Ohio

Bartlett - Snow

Tell us your hourly tonnage, the percent of moisture and the desired dryness and we will gladly submit our recommendation. There will be no obligation.

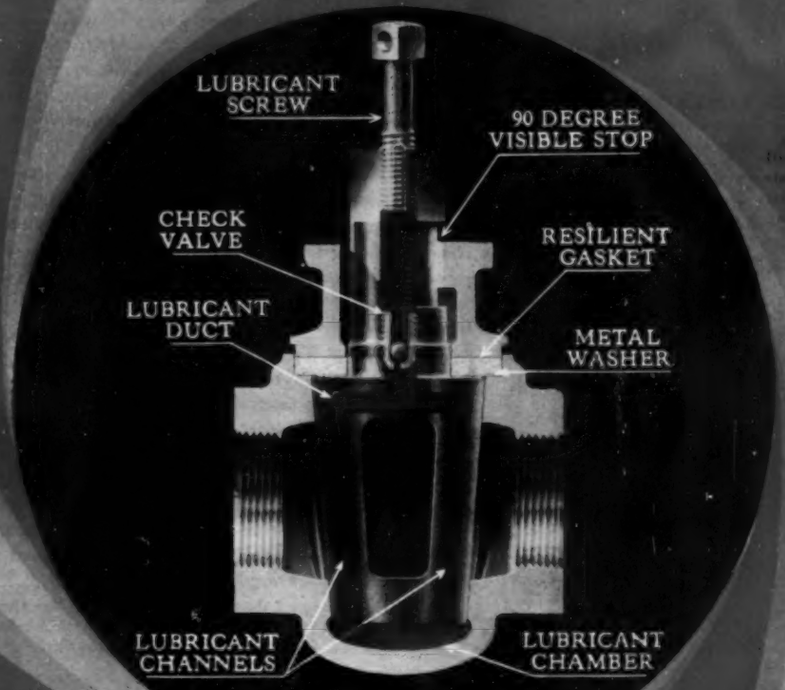
Nordstrom Valves

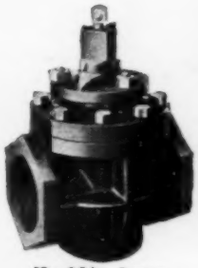
MERCO

Reg. U. S. Pat. Off.

embody positive lubricating feature—keeping the lines sealed against LEAKS permanently

No. 962—4-way





No. 164—2-way

Particularly Satisfactory for Service on

- Acid lines
- Alcohol
- Oil lines
- Gas distribution
- Gasoline and distillate
- Ore slime
- Emergency cocks
- Water purification
- Filter presses
- Industrial slimes of all types
- Metallurgical slimes
- Vegetable and mineral oils
- Soap kettles and lines
- Boiler blowoff
- Gas and air lines

Ask for Catalog

No. 105—2-way

Merco Nordstrom Valve Co.

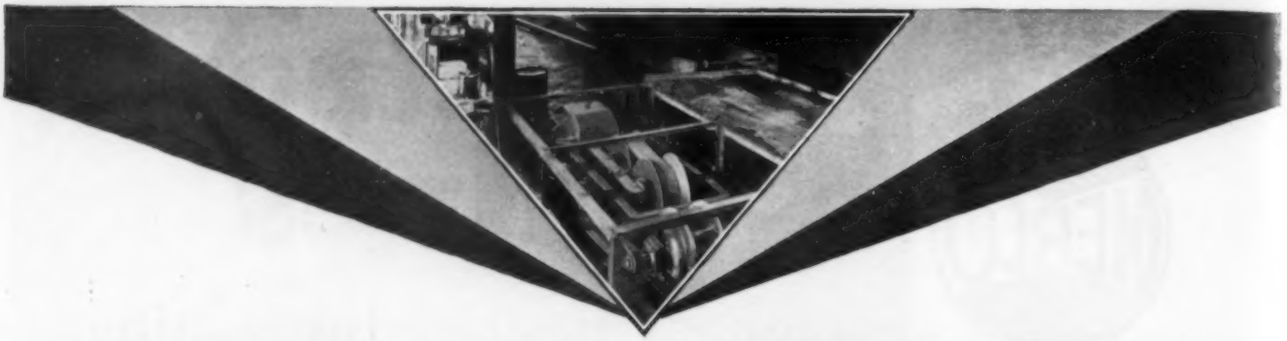
Subsidiary of The Merrill Company

Engineers.... Manufacturers

BOSTON—414 Pearl St. NEW YORK CITY—11 W. 42nd St. CLEVELAND—Engineers Bldg.
CHICAGO—176 W. Adams St. NEW ORLEANS—Masonic Temple Bldg. HOUSTON—Petroleum Bldg.
DALLAS—Magnolia Bldg. SAN FRANCISCO—142 Sansome St. LOS ANGELES—Union Bank Bldg.
BUFFALO—Genesee Bldg. SEATTLE—Coleman Bldg.

Factories: Oakland, Calif. and Belleville, N. J. *Agencies in Principal Cities*

Canadian Manufacturers—Peacock Bros. Ltd., Montreal, Que.—Cobalt, Ont.—Winnipeg, Man.—Vancouver, B. C.



WHAT THE REEVES MEANS TO THE MODERNIZATION OF PRODUCTION

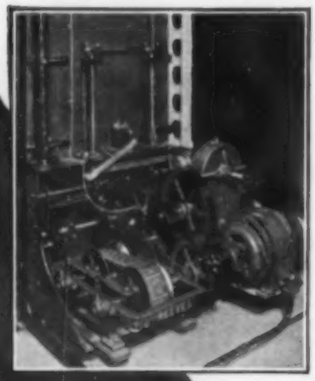
THE modern trend in production is merely a wide-spread movement toward greater efficiency. Mass production, elimination of waste effort, accurate machinery in place of hand labor . . . all these are steps toward the goal. And as the amount of machinery grows, and the number of machine processes increases, the need for controlling the speed of machinery becomes more apparent.

Single-speed machinery is out of the question. Step-adjustments are insufficient. Modern machinery must be *infinitely* adjustable in speed . . . must be capable of hairline speed changes . . . able to take advantage of every production change and to meet each variance in operating conditions with a like variance in operating speeds.

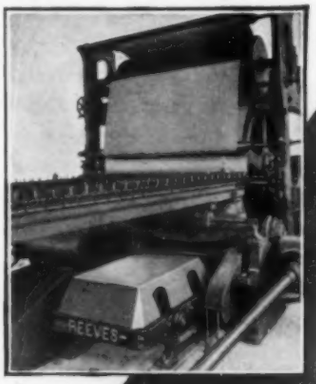
The REEVES Transmission represents the *only* method which gives *infinite* speed adjustability. It does not give just *steps* in speed . . . but *any* speed between fastest and slowest, even to the smallest fraction of a revolution. Simple, compact, inexpensive and easy to install. More than 40,000 REEVES Transmissions are now in operation, and more than 400 machinery manufacturers incorporate the REEVES as a standard part of the machines they build.

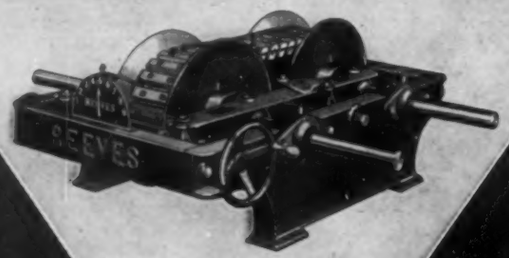
Fill in the coupon below and mail it today for the new REEVES Catalog, C-88, which gives more detailed information on REEVES advantages in specific industries.

Two REEVES Transmissions at the central control board which regulates the time cycle of the traffic lights in Chicago's loop district. Through these REEVES units the time cycle can be adjusted instantly *in exact accordance* with the traffic condition of the day and the hour.



The REEVES Transmission as standard equipment on the new Palmer Tenter Finishing Machine Manufactured by the Morrison Machine Company of Paterson, N. J. Through the REEVES the speed of this machine can be adjusted to suit *exactly* the weight of fabric being processed.





REEVES PULLEY CO., Columbus, Indiana

☐ Please send me your new catalog No. 88.

☐ Send me information on the uses of the REEVES in the _____ industry.

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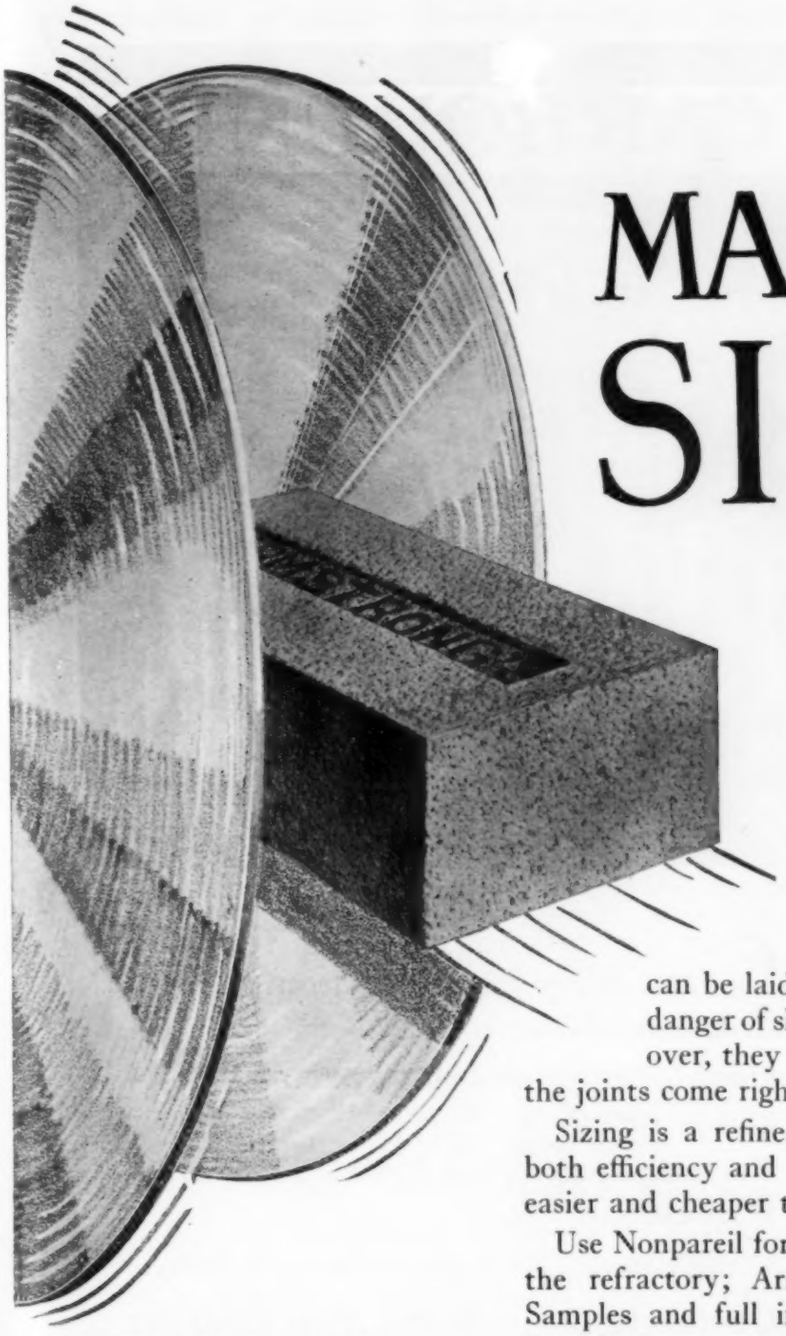
THE NEW REEVES Variable Speed Transmission

MODERN MACHINERY MUST BE ADJUSTABLE IN SPEED



All six sides of straight Armstrong's and Nonpareil Insulating Brick are now accurately machine sized. Every edge is straight and true and opposite faces are absolutely parallel.

MACHINE SIZED

EVERY standard straight Armstrong's and Nonpareil Insulating Brick is now machine sized—uniform, full dimensioned, straight edged. Passing through a series of parallel abrasive discs, accurately adjusted, all six surfaces are ground smooth and straight, and the finished brick are sized exactly to 9 x 4½ x 2½ inches.

Armstrong's and Nonpareil Brick can be laid with closer joints and therefore less danger of shrinkage cracks and heat leaks. Moreover, they lay up even with the refractory and the joints come right for ties or header courses.

Sizing is a refinement in manufacture which adds to both efficiency and usability—makes a better insulation, easier and cheaper to install.

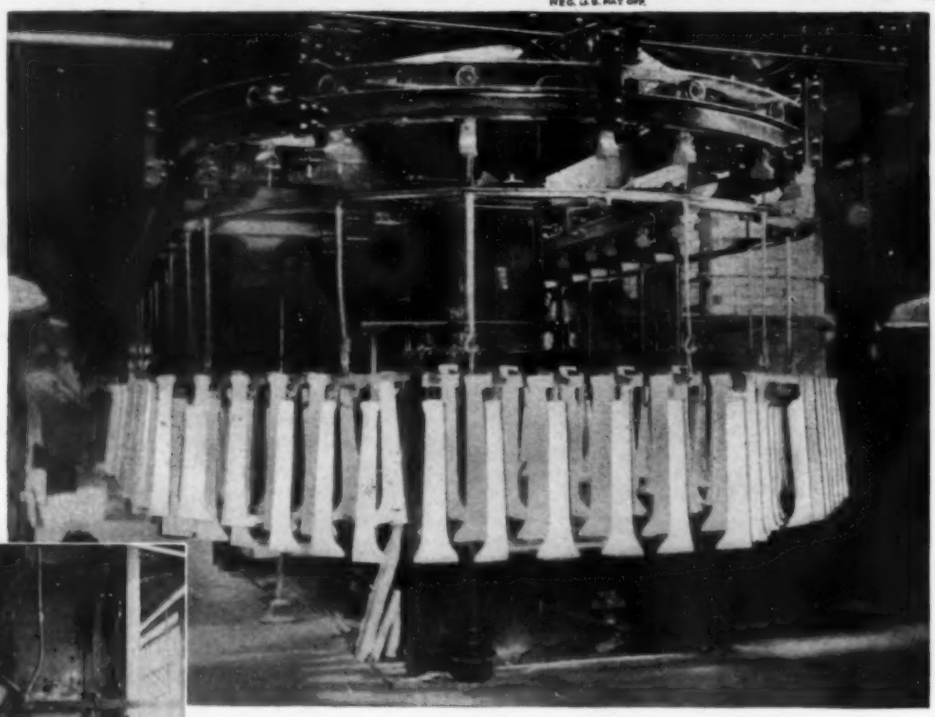
Use Nonpareil for temperatures up to 1600° F. back of the refractory; Armstrong's from 1600° to 2500° F. Samples and full information for either or both brick furnished on request.

ARMSTRONG CORK & INSULATION COMPANY
156 Twenty-fourth Street, Pittsburgh, Pa.

Armstrong's and Nonpareil Insulating Brick

For Furnaces, Ovens and Boiler Settings

BUILT-BY-CARBORUNDUM



CONTINUOUS enameling furnace heated by radiation from Carbofrax chambers.

Used for enameled stove parts—18 to 24 gauge metal.

Temperature in hot zone 1730° to 1750° Fahrenheit.

Production 2242 square feet per hour.

Operating fuel cost less than $1.00 per 1000 square feet of white ware.

Furnaces turning out 97% firsts.

Designed, built, installed by the Carborundum Furnace Engineering Department for the American Stove Company at Cleveland, Ohio.

Foundation Furnaces
FOR HEATING AND HEAT TREATING

Malleable Iron Annealing Furnaces

Continuous and Batch Type Furnaces

Ceramic Kilns

Special High Temperature Furnaces

DESIGNED, BUILT, INSTALLED

(Carborundum is the Registered Trade Mark of The Carborundum Company for its Silicon Carbide and is its exclusive property)

THE CARBORUNDUM COMPANY, PERTH AMBOY, N. J.

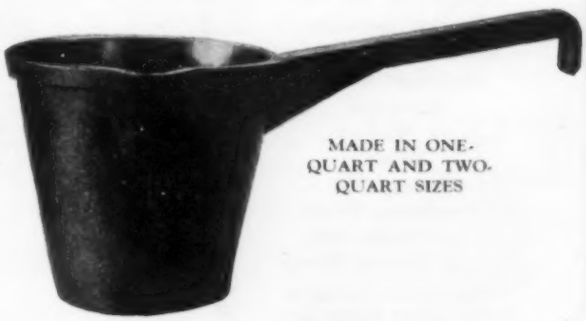
CONSIDERED only as a safety measure for the protection of workmen handling corrosive liquids, the Goodrich Flexite Bucket would be worth many times its very moderate cost.

It is made of a tough, acid-resistant compound which will crack or break only under actual destructive abuse. This outstanding durability eliminates the breakage losses inseparable from the use of glass, hard rubber and other fragile containers; and effects substantial savings.

Though its capacity is 3 gallons, the Flexite Bucket is light in weight, averaging only 3½ lbs. The handles are so fitted as to permit nesting.

Flexite Buckets and Dippers are recommended for the handling of a wide variety of corrosives at temperatures not exceeding 150 degrees F. They fill a definite need in most of the process industries.
For detailed information, write for Catalog Section 9425.

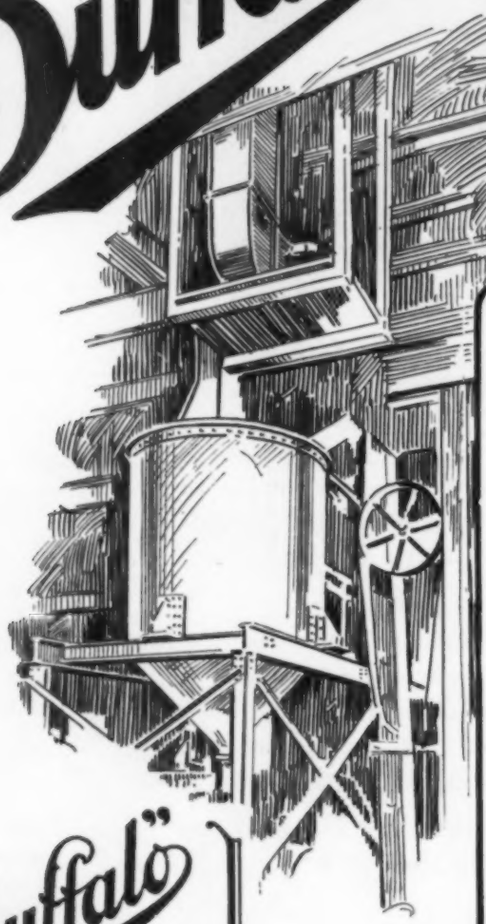
THE B. F. GOODRICH RUBBER CO.
Established 1870 Akron, Ohio



MADE IN ONE-QUART AND TWO-QUART SIZES

Goodrich *Flexite Acid Buckets*

"Buffalo" FANS



for every

PROCESS PLANT

Sugar, cement, rubber, paper, food products, explosives—no matter what you make, there is Buffalo Equipment suitable for use somewhere in your process from crude to finished product.

Huge, heavy plated stoker fans buzzing monotonously breathe life into thousands of furnaces in the process plants. Tall, narrow, Type "R" fans feed other fires in cupolas, retorts and special equipment. Thick-bodied exhausters pass a steady stream of materials to waiting machines, while other fans cool, dry, heat or moisten as the case may be.

Thousands of fans in thousands of plants, daily serving efficiently, silently. Designed by Buffalo these applications are universally successful because of our knowledge of air handling gained in a half-century of fan manufacturing.

If your plant problems involve blowing, exhausting, cooling, drying, heating or ventilating, our engineers will gladly go over the situation with you and make suggestions based on over fifty years' experience in this kind of work.

Buffalo Forge Company

501 Broadway, Buffalo, N. Y.

In Canada, Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

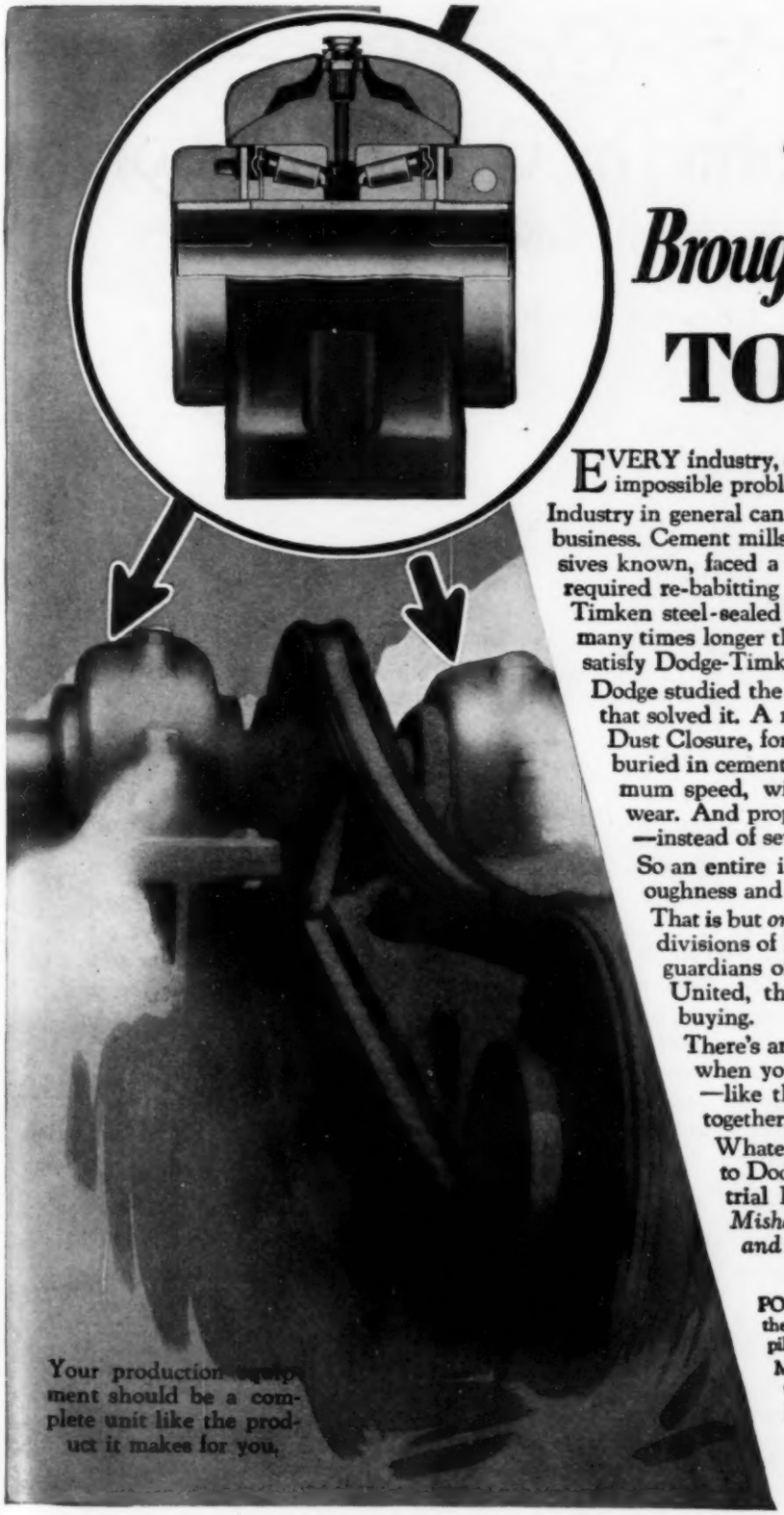
"Buffalo"

Equipment for the Process Industry

Rubber Coated Fans
Multistage Blowers
Exhausters
Air Washers
Driers
Heating and Ventilating Units
Acid Pumps and General Service Pumps

(Made by our associates Buffalo Steam Pump Co.)

1878 "Buffalo" 1928 — "Air Engineers for Fifty Years"



Your production equipment should be a complete unit like the product it makes for you.

. . . They Brought the "Impossible" TO DODGE

EVERY industry, every plant, sooner or later has a seemingly impossible problem to solve. Yours is surely no exception.

Industry in general can profit by a recent experience in the cement business. Cement mills, making one of the most destructive abrasives known, faced a costly production problem. Plain bearings required re-babitting in most cases within 90 days. The Dodge-Timken steel-sealed bearing would hold up for several years, many times longer than others — but still not long enough to satisfy Dodge-Timken engineers.

Dodge studied the problem for months, then built the product that solved it. A new Dodge-Timken Bearing with Abrasive Dust Closure, for cement mills was announced. Even though buried in cement dust, operating under heavy loads at maximum speed, with proper lubrication there would be no wear. And proper lubrication meant grease once a month —instead of several times daily!

So an entire industry benefits from Dodge ability, thoroughness and unmatched facilities.

That is but *one* recent accomplishment of *one* of the four divisions of Dodge. Individually, they stand as stalwart guardians of low cost, high speed industrial production. United, they offer you the economy of centralized buying.

There's an added measure of service and satisfaction when your production equipment is a complete unit —like the product it makes for you. Parts made together, work best together!

Whatever your problems — or your needs—come to Dodge — the World's Market Place for Industrial Equipment. *Dodge Manufacturing Corp., Mishawaka, Ind., Factories at Mishawaka, Ind. and Oneida, N. Y.*

The Four Divisions of Dodge

POWER TRANSMISSION — Complete equipment for the transmission of power. Every type of pulley, hanger, pillow block, etc.

MATERIAL HANDLING — Every type of conveyor to handle any type of packaged or bulk material.

DODGE-TIMKEN BEARINGS—For power transmission and machine applications. A type for every service.

SPECIAL MACHINERY—A manufacturing department for those who prefer to devote their attention to selling rather than making.

POWER TRANSMISSION

MATERIAL HANDLING

DODGE

MISHAWAKA

SPECIAL MACHINERY

DODGE-TIMKEN BEARINGS

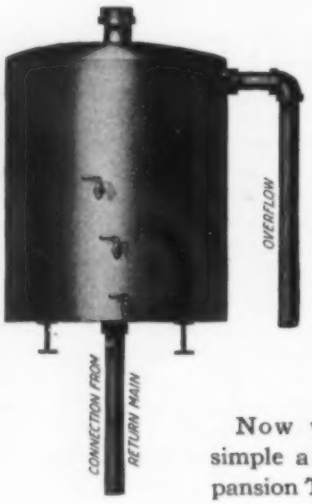
Parks-Cramer

Industrial Heating by Oil Circulation

By MERRILL PROCESS

Chapter the Fifth

Expansion Tank



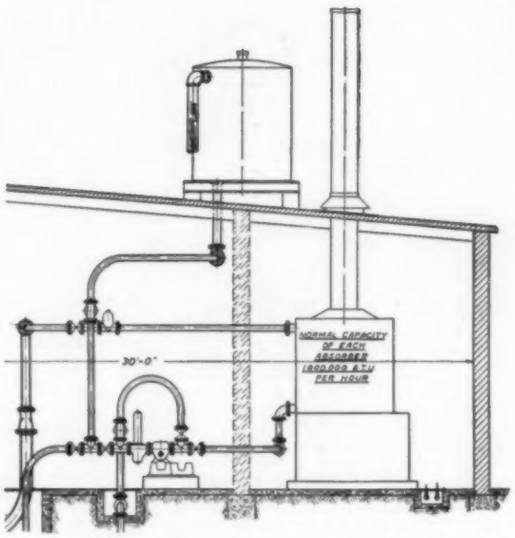
In the earlier pages of this series you have read about the Absorber, the Circulating Oil Pump, the Piping System, and the Circulating Oil—otherwise known as Meprolene.

Now we come to so simple a thing as an Expansion Tank.

And why an Expansion Tank? You know that most things that are heated have a habit of expanding. The expansion or increase in volume of a liquid is proportional to the "Coefficient of Volumetric Expansion." Meprolene Circulating Oil has a value of 0.000486, therefore, a given quantity will increase twenty-five (25) per cent in volume, if its temperature is raised 514°F.

This means that one thousand (1000) gallons at 60°F will increase to twelve hundred and fifty (1250) gallons at 574°F.

In most Merrill Process installations, the Expansion Tank capacities are figured to handle this increased volume and something to spare, in case more equipment is later added to the system.



The location of these tanks must be carefully selected, readily accessible and yet out of the way. The tank riser should be provided with bends and offsets to allow for its own expansion without setting up stresses on the tank bottom.

There are three cocks on the side to determine the depth of the oil, and an overflow connection close to the top. For convenience, an inspection cap is provided, but the tank is securely welded with closed top to protect against the weather.

You will appreciate then that an expansion tank is more than just a tank. It is a respectable and necessary piece of equipment, silently performing its daily task in order that the rest of the parts can do theirs.

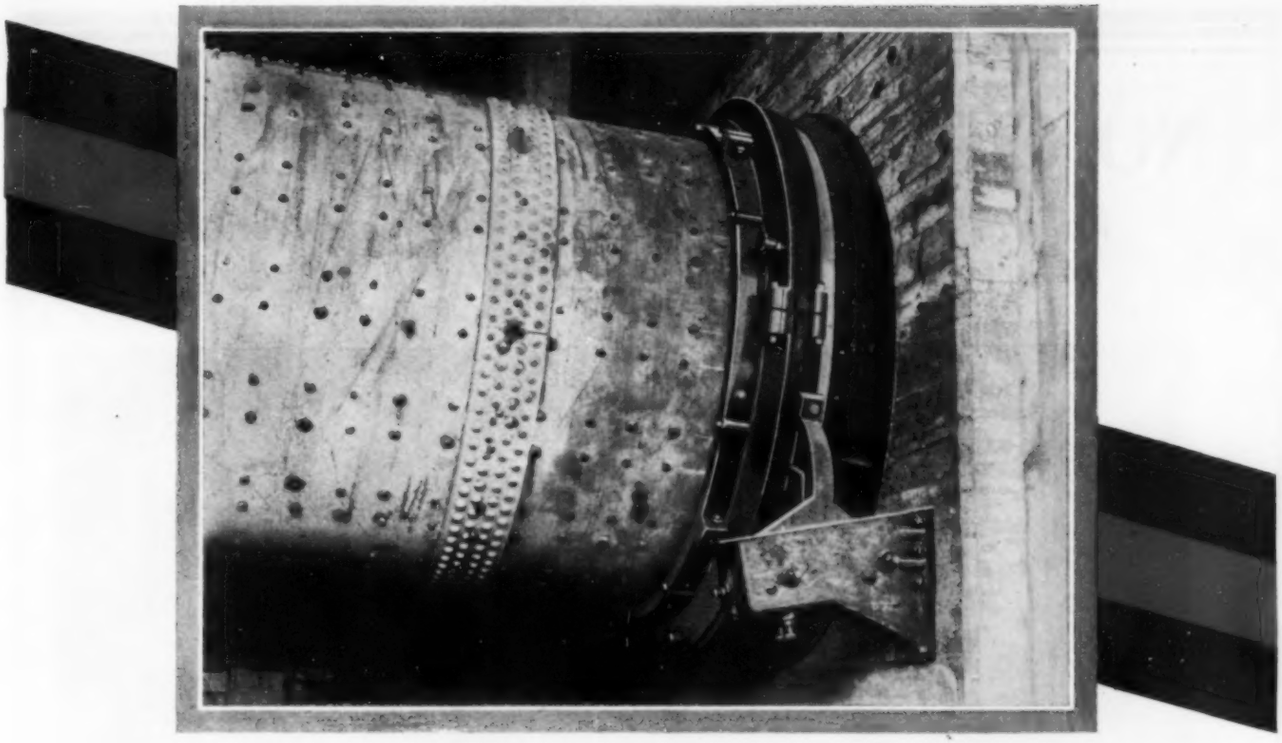
Merrill Process methods are approved by largest Insurance Inspection Departments.

Parks-Cramer Company

Engineers and Contractors · · · Industrial Piping and Air Conditioning

1102 Old South Building, Boston, Mass.

Represented in England and on the Continent by The Kestner Evaporator & Engineering Company, Ltd., London, England



Huron Seal Rings

The Huron Seal Ring was designed particularly for horizontal, rotary kilns and dryers and it is the only seal ring on the market making use of the basic principal of gravity.

It maintains a constant, tight seal automatically by gravity —without springs or other contraptions of any kind. Adjustment is never necessary.

Huron Rings wear and wear—the first one installed more than six years ago is as good as new—and it's not been touched since the day it was installed.

For conserving heat, assisting in temperature control or maintaining a constantly tight, dust-proof seal, Huron Rings are in a class alone. *Their first cost is their only cost.*

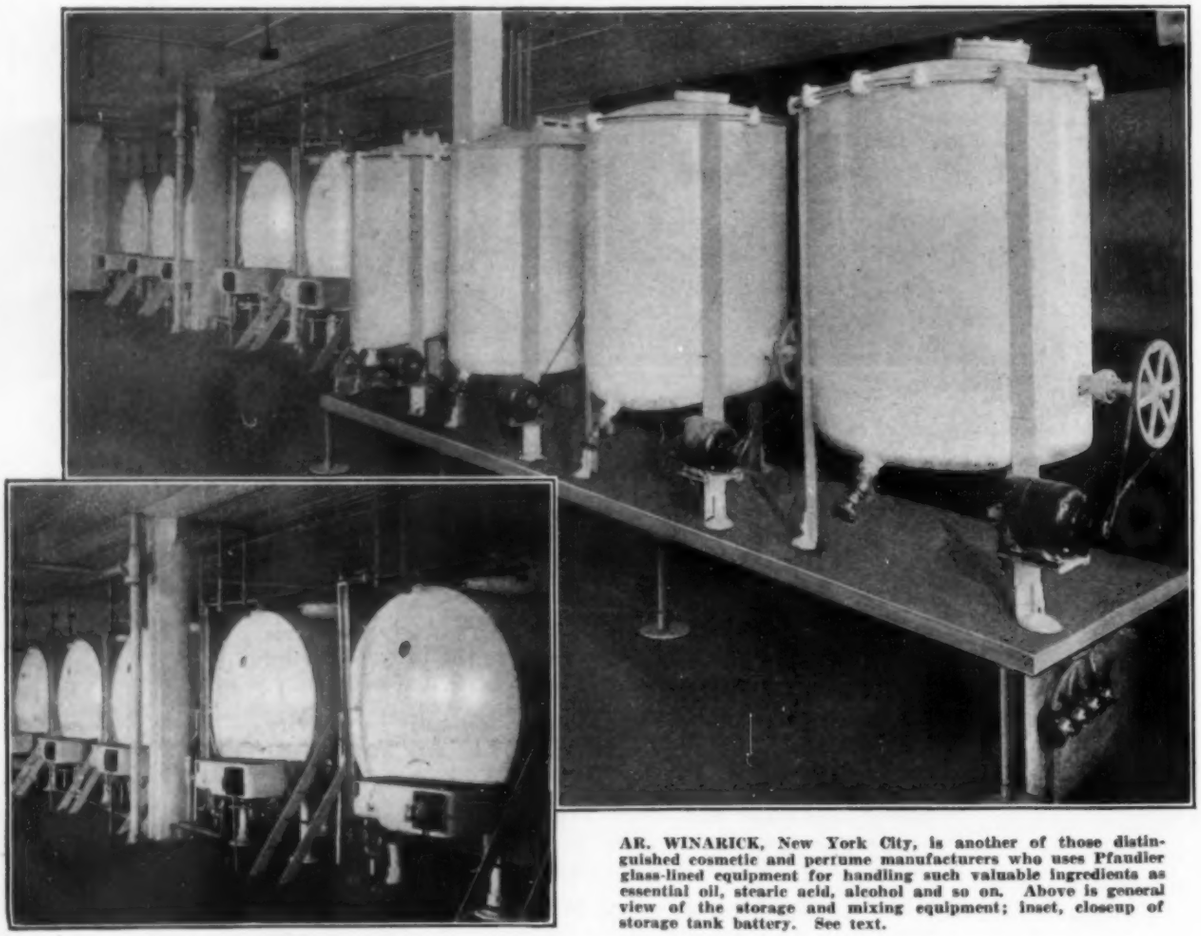
We also manufacture Huron Speed Reducers—built to meet the requirements of the Process Industries. Separate catalogs are issued on Huron Seal Rings and Huron Speed Reducers. One or both will be sent on request.

HURON INDUSTRIES, INC.
General Sales Office: 1440-1442 Builders Bldg., Chicago, Ill.
The factory is in Alpena, Michigan

HURON Seal Rings
for ROTARY KILNS-DRYERS-COOLERS

NO CHANCES TAKEN HERE!

Valuable ingredients given thorough protection in PFAUDLER GLASS-LINED equipment



AR. WINARICK, New York City, is another of those distinguished cosmetic and perfume manufacturers who uses Pfaudler glass-lined equipment for handling such valuable ingredients as essential oil, stearic acid, alcohol and so on. Above is general view of the storage and mixing equipment; inset, closeup of storage tank battery. See text.

"An ounce of prevention is worth more than a pound of cure." A "sick business" is always difficult to cure. Take precautions that will prevent sickness . . . . it represents only a small part of the cost of cure!

Why impair the ingredients used in your products with metallic contamination when it costs so relatively little to prevent this? Let us tell you what we have accomplished during the last forty years in eliminating such trouble. Address your letters to Pfaudler, the originators and world's largest builders of glass-lined steel acid resisting equipment.

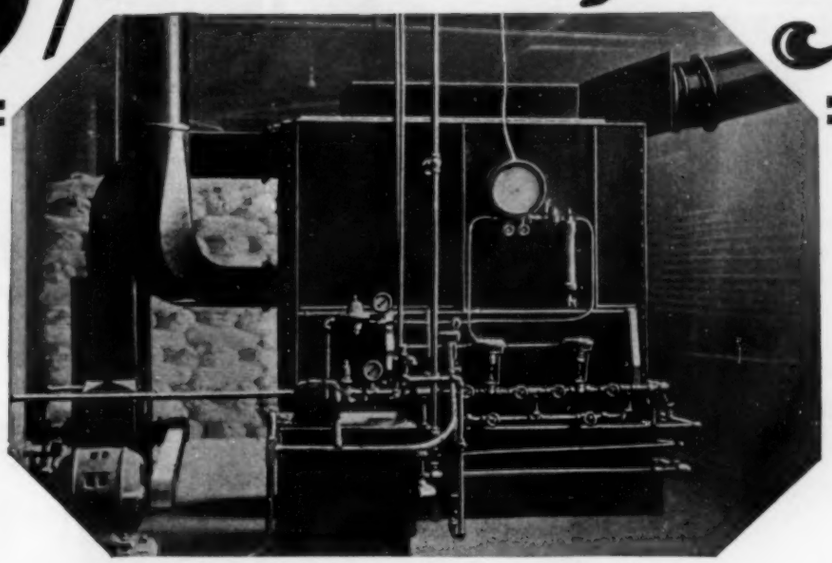
APPROVED by the TRADE — Pfaudler

THE PFAUDLER COMPANY—*Chemical Division*—Rochester, N. Y.

NEW YORK 8 W. 40th St. | ELYRIA, O. Pfaudler-Elyria Div. | CHICAGO 1442 Conway Bldg. | SAN FRANCISCO 122 New Montgomery St.

20% More Capacity

with the Raymond KILN-MILL



Thermostatically-controlled heater for supplying hot air of air-drying system in Raymond Kiln-Mill, installed at a prominent Delaware chemical plant. Duct shown at left leads to pulverizing unit in adjoining room. See illustration below.

Another successful installation heard from!—a leading manufacturer of pigments and chemicals reports wonderful results in producing lithopone at his Delaware plant with the KILN-MILL, (a Raymond mill equipped for drying and pulverizing in one operation).

In recent test runs made with and without the air-drying action, a most significant achievement was the output increase obtained from the *same pulverizer* when heated air was introduced into the grinding chamber.

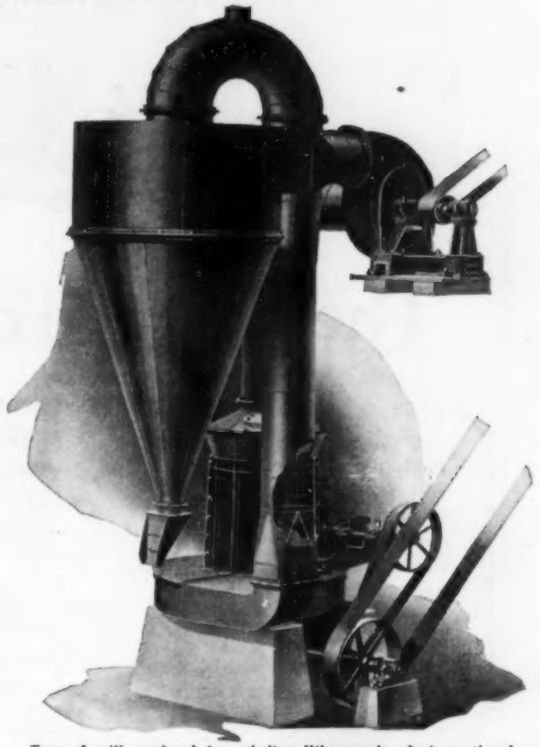
First, the roller mill was operated without the heater. The hourly capacity averaged 6940 pounds of finely ground lithopone.

Then the heated-air supply was connected and the pulverizer operated as a Kiln-Mill. At once the moist, scaly powder disappeared from the inside surfaces of the mill and piping, and the capacity rose to 8330 pounds per hour—an increase of 20%—and the moisture content of the product was reduced to twenty-five thousandths of one per cent.

Detailed figures on this test will be sent you on request, if your engineers are interested in having the complete data for reference.

Remember that the Kiln-Mill is applicable to many different kinds of materials, and it may be profitably used on your product.

Write for a copy of the new Kiln-Mill Bulletin.



Type of mill employed for grinding lithopone in plant mentioned above—Raymond No. 2 Roller High-side Mill equipped with air separation and air drying. It *dries, grinds* and *separates* the product simultaneously and automatically. No pre-drying equipment needed.

RAYMOND BROS. IMPACT PULVERIZER CO.

Subsidiary of the

International Combustion Engineering Corporation

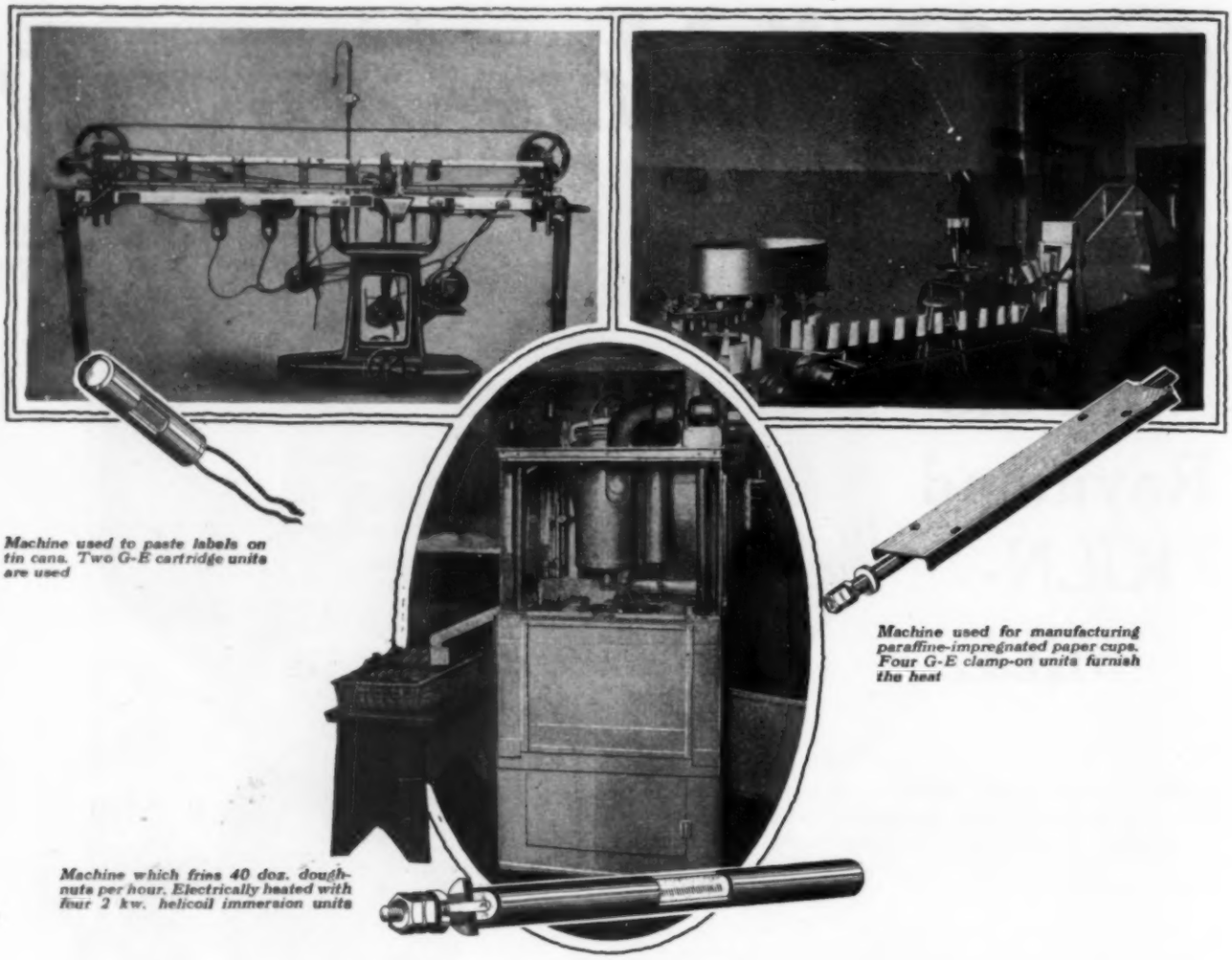
MAIN OFFICE AND WORKS:

1311 NORTH BRANCH STREET, CHICAGO

342 Madison Ave.
NEW YORK

Guardian Building
CLEVELAND

Subway Terminal Bldg.
LOS ANGELES



Machine used to paste labels on tin cans. Two G-E cartridge units are used

Machine used for manufacturing paraffine-impregnated paper cups. Four G-E clamp-on units furnish the heat

Machine which fries 40 doz. doughnuts per hour. Electrically heated with four 2 kw. helicoil immersion units

The Trend Toward Electric Heat

Although electric heat will not supplant all other forms of heat for industrial purposes, there are processes in every industry where it is the ideal heat—the most economical heat—the heat that ultimately will be used.

ULTIMATELY
ELECTRIC HEAT
IN EVERY INDUSTRY

Electric Heat! Clean, safe, economical heat; under perfect and automatic control; placed just where you want it; requiring no attention from anyone. This is the heat that is going into thousands of process machines which formerly used fuel or steam.

Cartridge units, clamp-on units, or helicoil immersion units—no matter which type of electric heating unit you desire, you can find none as good as those made by General Electric—because General Electric originated and perfected all these units. Carefully designed, sound of construction, compact and efficient, G-E units insure the most convenient and economical method of heat application to machines. Hundreds of thousands are in use. Write to your nearest G-E office for complete information.

570-72

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

When we were boys

We didn't appreciate the value of quality when we were youngsters. Our principal thought was, "Let's go!"

But as you and I have grown older, we have learned that quality is exceedingly important.

One make of automobile, for instance, will sell for $1500. Another automobile, no larger in size and no heavier, but made with much greater care, sells for $4500. The difference, $3000, is the "quality" difference.

We are proud to say that NEWARK Wire Cloth, and NEWARK products, are made as well as we know how to make them. I, personally, have made and have supervised the making of wire cloth for more than a half century. Our mechanics are all thoroughly schooled and skilled in their work.

Take for example our recent world's record 400-mesh wire cloth which is the finest ever made. The wires used in that cloth drawn in our own plant, are only one-thousandth of an inch in diameter. 160,000 square openings per square inch. Could there be more convincing proof of quality and craftsmanship than this?

It costs us more to make NEWARK Wire Cloth, of course. We guarantee the correct number of wires per inch; the correct spacing; the correct wire diameters; the correct weave; and the highest grade metal obtainable for the purpose.

Before placing that next order, look into the QUALITY of what you are buying and you will be well repaid in the end. Don't be blinded by low price.

JOHN C. CAMPBELL, *President.*

We make wire cloth of all malleable metals: monel, aluminum, brass, copper, bronze, phosphor bronze, nickel, steel, gold, silver, platinum, nickel chromium, tinned metals, special alloys, etc. We carry a very large stock, hence can usually ship promptly. Ask for our new Catalog No. 26. A post card request will bring it.

New NEWARK Testing Sieve. Corners are rounded so materials can't catch. All soldering on outside. Wire Cloth more easily replaced than on any other sieve.

NEWARK WIRE CLOTH CO.

350-364 Verona Avenue
Newark, N. J.

Branch Office:
66 Hamilton St., Cambridge, Mass.

NEWARK

An Emblem of QUALITY *and* SERVICE

A Guarantee of SATISFACTION

NATIONAL QUALITY and SERVICE are behind every NATIONAL PRODUCT. They are your guarantee of satisfaction.

Careful study to increase the scope of NATIONAL SERVICE has resulted in such developments as NATIONAL SEAMLESS BLANKETS for rotary filters and NATIONAL DOUBLE WEAVE FILTER CLOTH.

The use of NATIONAL FILTER CLOTH is an assurance of economical and efficient operating results.

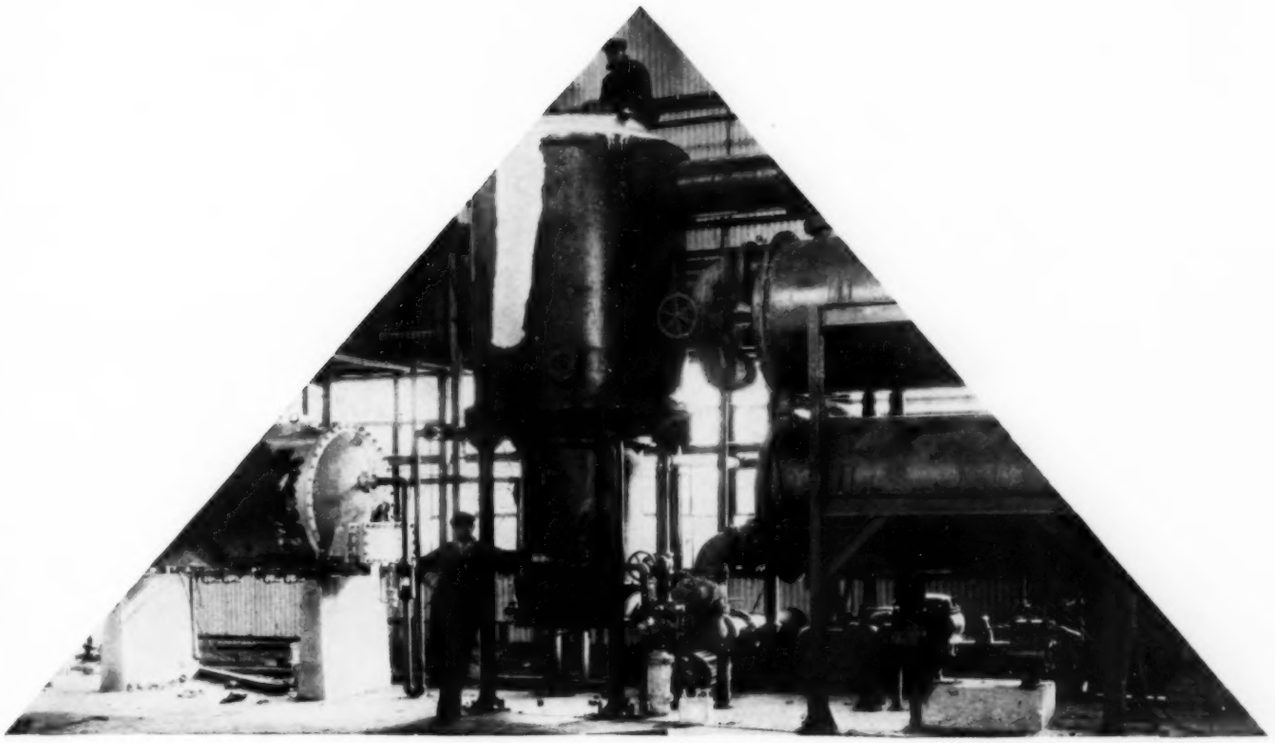
If you are not now using NATIONAL PRODUCTS in your operations it will pay you well to investigate.

A request for a booklet containing our various styles of filter cloth involves no obligation.

THE NATIONAL FILTER CLOTH & WEAVING CO.

1717 Dixwell Avenue, New Haven, Conn.

[*"Manufacturers of Cotton Filter Cloth Exclusively"*]



THIS rapid circulating evaporator with condensers, coolers and pumps was designed, built and installed by the J. P. Devine Manufacturing Company, Inc., for a client who subscribes heartily to an open-minded policy on equipment replacement. He checks the cost of operating the old against the economy and increased production of the modern units. The result is always a close-up picture of actualities. And cold fact has never been known

to lead any business up a blind alley. With greatly increased plant facilities at Buffalo, N.Y., and Mt.Vernon, Ill., we are in a stronger position than ever in our quarter of a century of pioneering and leadership to serve the complete Process Field.

WE suggest a severely critical survey of your plant equipment because the place for your company to make money is within the plant itself. Modern methods and modern equipment will return profits in reduced operating costs, increased volume of output and a higher quality uniformity. Your engineers are welcomed to our laboratories. Our own staff will be glad to co-operate.

J. P. Devine Manufacturing Company, Inc.

Executive Office: Buffalo, N. Y.
Plants: Buffalo, N. Y., and Mt. Vernon, Ill.

New York Headquarters
51 E. 42nd Street

Chicago Headquarters
122 S. Michigan Avenue

A. C. Motors of All Types

Wagner makes every commercial type of a. c. motor, . . . polyphase, and single-phase including squirrel-cage, repulsion-induction, starterless, slip-ring and Fynn-Weichsel. Wagner engineers know the best motor for each application . . . their recommendations are unrestricted.

Wagner engineers invite you to submit your motor problems. They can advise without prejudice.

Literature on Request

WAGNER ELECTRIC CORPORATION
6400 Plymouth Avenue, St. Louis, U. S. A.

Wagner Sales Offices & Service Stations in 25 Principal Cities

Products: FANS . . . . Desk, Wall and Ceiling
TRANSFORMERS . . . Power, Distribution and Instrument
MOTORS . . . Single-phase, Polyphase and Direct Current

Wagner
. . . quality

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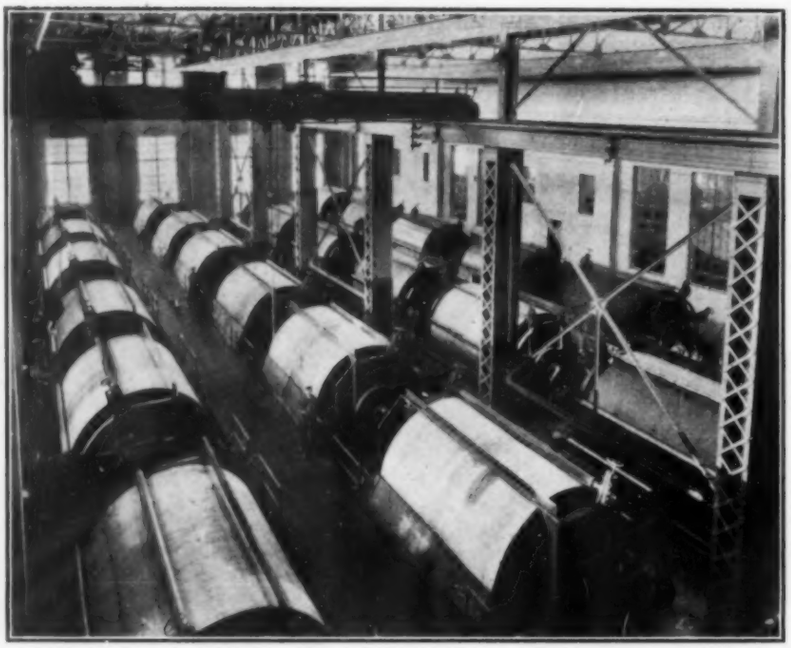


Oliver Continuous Filters used in sewage disposal work in one of the middle western cities.

Consider the Variables Possible with *Eight* Types of Filters

Some of the Different Filtering Requirements and the Types of Filter to use

Normal Pressure and Heat
Sweetland Pressure Filter

High Pressure and Heat and Refrigeration
Kelly Pressure Filter

Pressure with Rotating Elements
Sweetland Cantilever Filter

Vacuum with Rotating Elements
American Continuous Filter
Oliver Continuous Filter

Combined Thickening and Filtration
Oliver-Borden Thickener
Sweetland Thickener

Small Batch Work, Very Dry Cake, Gummy Material
United Filter Press

Vacuum Pumps
Centrifugal Pumps
Olivite Acid Pumps

In a single type of filter the variables are limited. This naturally limits its application.

But consider the number of variables with eight different types of filters. How much nearer you can come to securing the best filter unit for your problem.

Oliver United has *eight* different types of filters, each with a number of modifications. Oliver United Engineers have the broadest kind of experience to back up their recommendations.

It will be to your advantage to consult with Oliver United on your filtering problems.

OLIVER UNITED FILTERS

Successor to Oliver Continuous Filter Co. and United Filters Corporation

NEW YORK, 33 West 42nd St. CHICAGO, 565 W. Washington Blvd.
SALT LAKE CITY, Felt Building
LOS ANGELES, Central Building SAN FRANCISCO, Federal Reserve Bank Building

London Paris Johannesburg Tokyo Melbourne Manila
Honolulu Montreal
Halle, Germany Scheveningen, Holland Soerabaia, Java

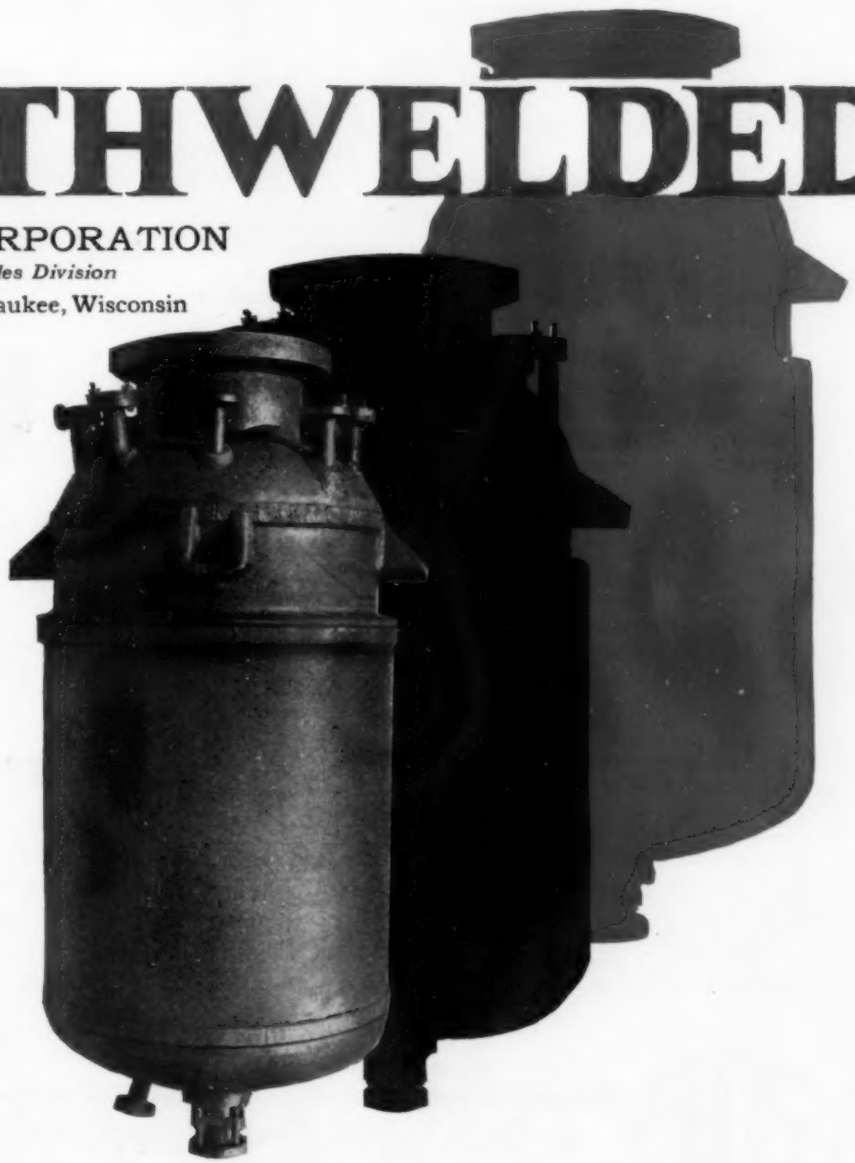
Factories: Hazleton, Pa. Oakland, California
Cable Address: Oliunifilt.

The Trend . . . . Towards Higher

Temperatures and Pressures, not only permits faster and more economical production, but is constantly opening up new possibilities for the process industries, many of them through the use of Smith-Welded Vessels.

SMITHWELDED

A. O. SMITH CORPORATION
Pressure Vessel Sales Division
General Offices — Milwaukee, Wisconsin

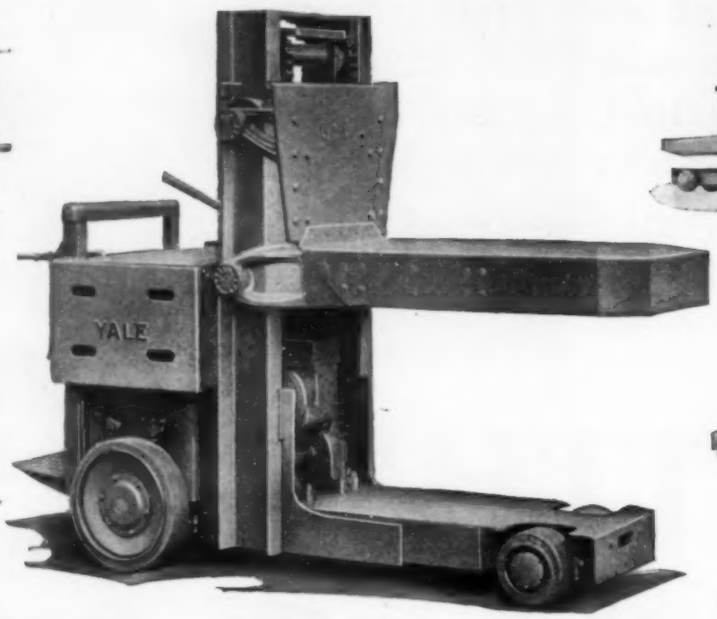


PRESSURE VESSELS

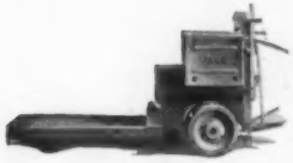
TRADE **YALE** MARK

Electric Industrial Trucks

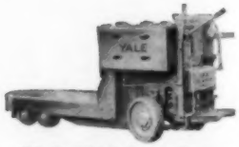
Yale K20 and K21, 2- and 3-Ton High Platform Trucks



Yale K22 2-ton High Lift Truck



Yale K23E 3-ton Low Lift Truck

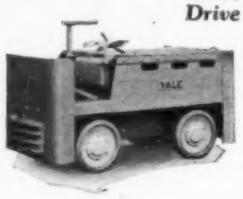


Yale K26 5-ton Low Lift Truck

Yale K25 3-ton High Lift Truck

Yale K24A Three Wheel Tractor-Truck

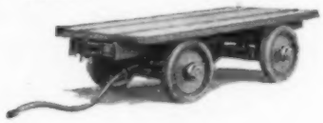
Yale K24C Four-Wheel-Steer, Four-Wheel-Drive Tractor



Yale K68 Crane on K23 Low Platform Truck

Yale K24B Three Wheel Heavy-Duty Tractor

Yale K67 Four-Wheel-Steer Rubber Tired Trailer



The Yale Line of Electric Industrial Trucks

The Yale line of Electric Industrial Trucks and Tractors embodies the utmost in modern mechanical improvements, many exclusive with Yale.

Beginning with almost instant acceptance, the Yale K Series of trucks has steadily built up what is now a definite and outstanding demand.

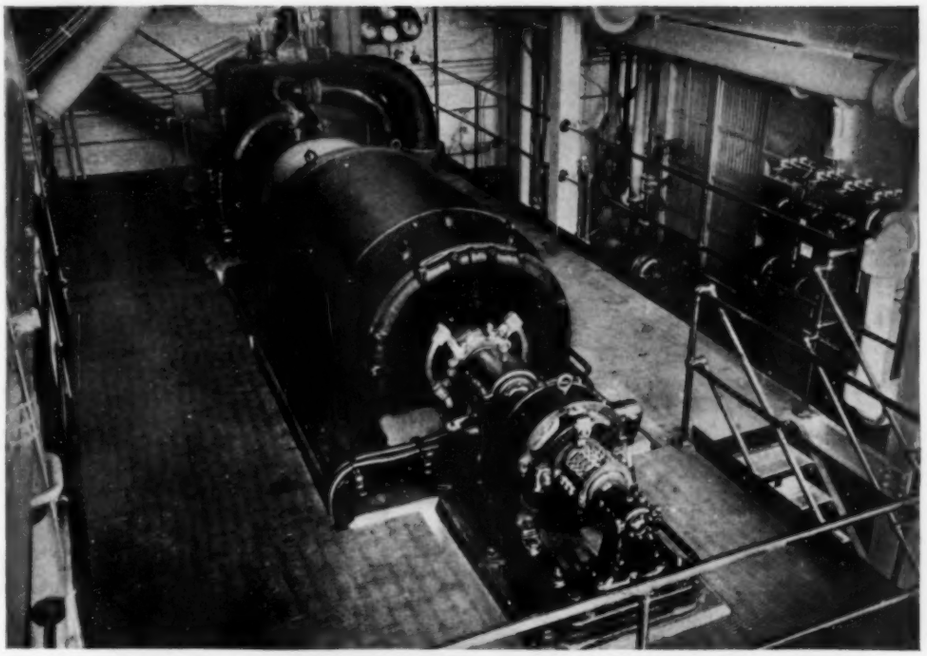
Our engineers will gladly confer with you and assist you to solve your particular problem. If a Yale Truck can profitably serve you, it will be recommended—if it cannot, we will not attempt to sell you.

The Yale & Towne Manufacturing Company
Stamford, Conn., U. S. A.

YALE **Hoisting and Conveying Systems**

YALE MARKED IS YALE MADE

Modernizing with Westinghouse Turbines



A 2500 Kw. Westinghouse Turbine Generator Unit in the International Paper Company's Plant at Fort Edward, N. Y.

Paper Mill Generates Power at Low Cost

YOU should produce power from steam used in manufacturing processes and for plant heating by first passing the steam through a suitable turbine. Steam thus utilized performs a double duty and results in high economy from the fuel burned.

A Westinghouse 2500 kw., non-condensing, bleeder-type, turbine generator unit accomplishes this for the International Paper Company. Steam for pulp digesters is bled from an intermediate stage of the turbine, while the exhaust steam from the turbine is used in paper machine driers, and for plant heating. Practically all the power used in this paper mill is thus obtained cheaply as a by-product of its process steam.

Your plant may present the opportunity for generating by-product power at a low cost by the use of a Westinghouse industrial type turbine. Our engineers gladly will co-operate in a study of your plant requirements.

Consult our nearest office.

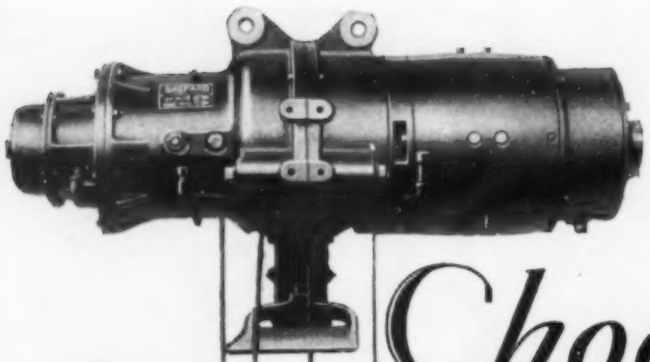
Power Plant Equipment includes

- Air Ejectors
- Feed Water Heaters
- Generators
- Generator Air Coolers
- Heat Exchangers
- Jet and Barometric Condensers
- Reduction Gears
- Surface Condensers and Auxiliaries
- Stokers
- Turbines

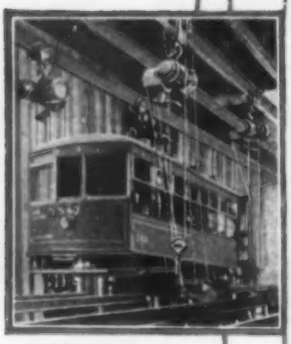
Westinghouse Electric & Manufacturing Company
South Philadelphia Works Philadelphia, Pa.
Sales Offices in All Principal Cities of the United States and Foreign Countries

Westinghouse

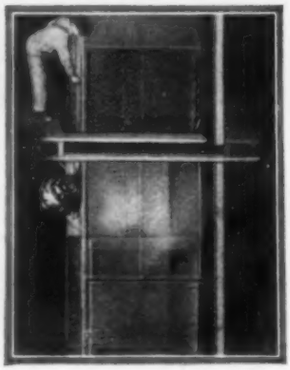
T 30118



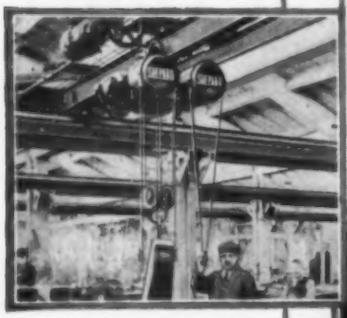
Choose the hoist precisely suited to your job!



Shepard floor operated hook suspension type.



Shepard stationary type for permanent mounting. Shown here, applied to elevator.



Shepard close clearance type for low headroom requirements.

Shepard long winding drum type for long lifts.

Shepard Parallel Type with plain push trolley.

No one hoist can meet the thousands of widely varying demands of industry without sacrificing something in either speed, efficiency, or dependability. Planned load handling reduces costs to a minimum because it employs the hoist on the correct type and size to fit precisely the load—clearance—length of lift—speed—and other essential requirements.

Shepard offers industry more than 5000 standard types and sizes—the most complete line of hoists in America. Every hoist is pre-proved in the service for which it is recommended; is engineered on the experience of more than 25 years devoted exclusively to the design and construction of hoisting machinery.

Such features of design as the "Balanced" Drive, automatic oil bath lubrication, enclosed unit construction and permanent alignment, contribute to the consistent, trustworthy service of Shepard Electric Hoists. Maintenance is reduced to a minimum—production increased materially—when these labor-saving hoists are assigned to a job.

Let a Shepard representative assist you in selecting the Shepard Electric Hoist precisely suited to your job. A letter to Montour Falls will bring you whatever information and assistance you may require.

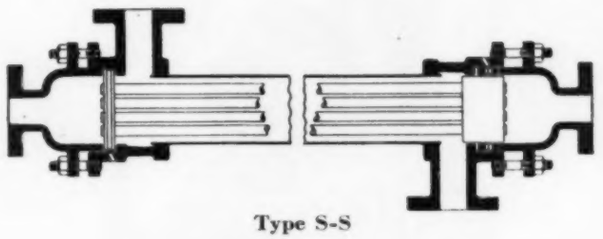
SHEPARD ELECTRIC CRANE & HOIST CO.
382 Schuyler Ave., Montour Falls, N. Y.
Member Electric Hoist Manufacturers Association

SHEPARD
ELECTRIC CRANES & HOISTS

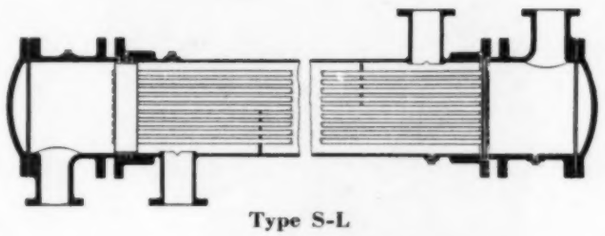
Largest Manufacturers of Electric Hoists in America

Branch offices are maintained in principal cities

NO LEAKAGE



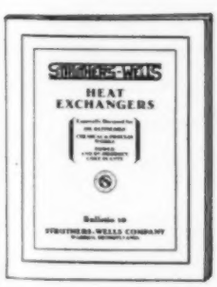
Type S-S



Type S-L

With the S. W. Heat Exchanger

CORRECT design and careful workmanship assure the user of leak proof joints—and absolute freedom from inter-leakage—a fault so common in many exchangers. No jamming and pulling of tubes—no lost time and labor—the full guided floating tube plate takes care of all play, expansion and contraction—a definite improvement over existing types. Efficient, modern-built in sizes and capacities to meet every productive need—this S.W. Heat Exchanger is solving the problems in many industries as they may relate to the heating or cooling of liquids—or the condensation of vapors.



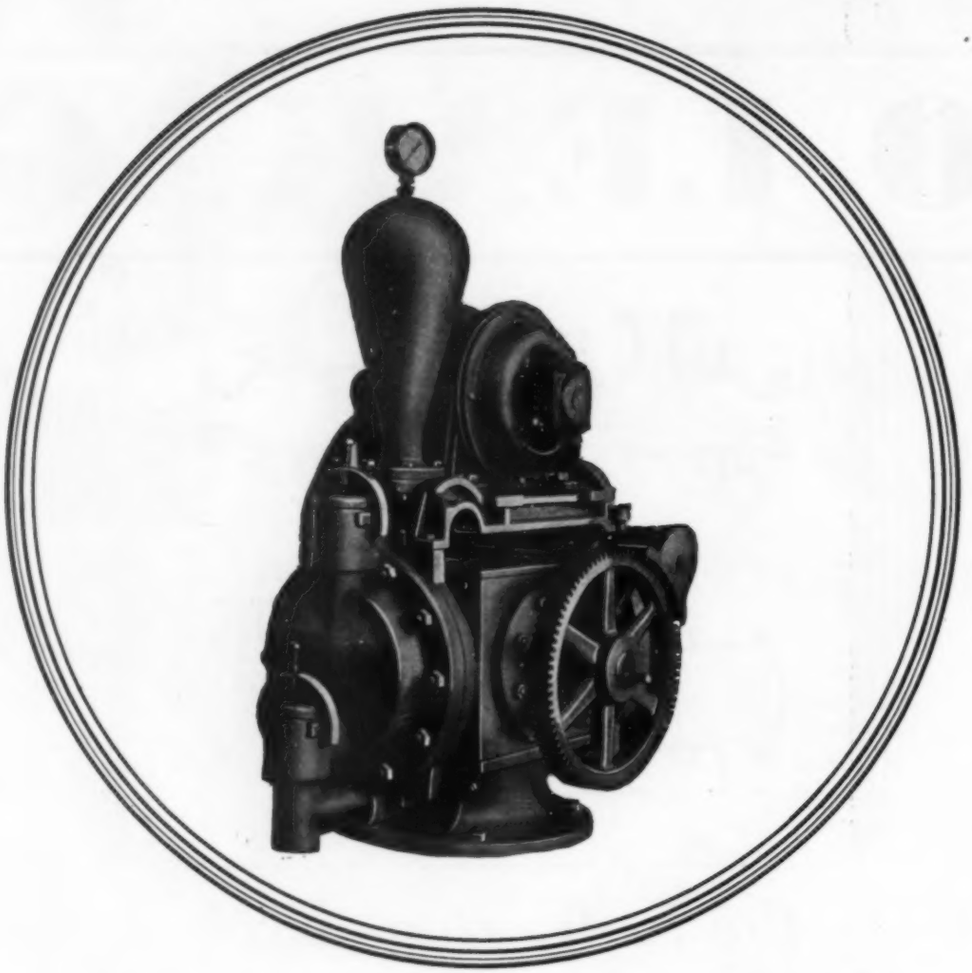
Send for a copy of our Bulletin No. 10—mailed gladly on request.

The single design permits using singly or in series by merely bolting together—assuring flexibility and high salvage value. Can be used in vertical or horizontal position.

STRUTHERS-WELLS COMPANY

STRUTHERS-WELLS COMPANY

WARREN, PENNA. *Branch Offices:* New York Philadelphia Buffalo Chicago San Francisco



100 POUND PRESSURE
SHRIVER DIAPHRAGM PUMP

For pumping thick and heavy sludges, corrosive, gritty and granular liquids, etc., against pressures up to 100 pounds in filter press work and in pumping this same class of materials in other plant operations, Shriver Diaphragm Pumps are giving unequalled service in the chemical and chemical process industries. Shriver Diaphragm Pumps have many features such as completely supported diaphragms, self cleaning ball type valves, oversize liquid passages, removable liquid ends, all moving parts submerged in lubricant. Shriver Diaphragm Pumps will give an unfailing, superior service in operations which pumps of other types are not fitted either by design or construction to perform.

Let us give you the details. Your inquiries are solicited.

T. SHRIVER & COMPANY
ESTABLISHED 1860
808 HAMILTON STREET
HARRISON - N. J.

A FILTER PRESS FOR EVERY PURPOSE

SHRIVER

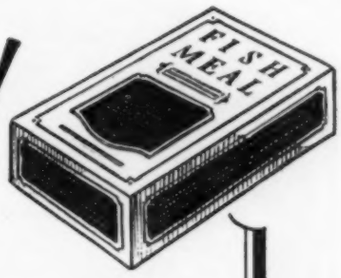
T. SHRIVER & CO. FILTER PRESSES HARRISON, N.J.

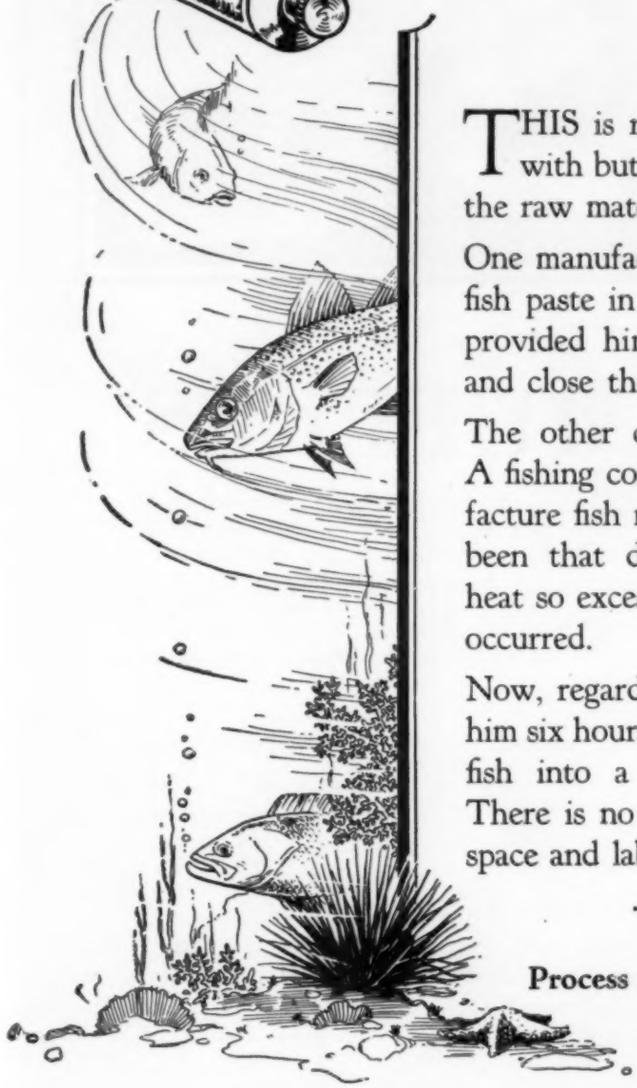
FILTER PRESSES FILTER CLOTH DIAPHRAGM PUMPS

ANOTHER UNUSUAL PROBLEM SOLVED

№4

Fish in tubes and fish in powder!





THIS is really two separate cases with but one point in common—the raw material—fish.

One manufacturer wanted to put up fish paste in collapsible tubes, so we provided him with machines to fill and close the tubes.

The other case was more unusual. A fishing company wanted to manufacture fish meal. The difficulty had been that drying was so slow, or heat so excessive, that spoilage often occurred.

Now, regardless of weather, it takes him six hours to convert fresh caught fish into a dry, granular powder. There is no spoilage, he saves time, space and labor.

Process problems that involve—

Absorption	Cooling	Impregnation
Briquetting	Distillation	Measuring
Coating	Drying	Mixing
Compressing	Evaporation	Weighing
	Filling	

What is your process problem? Bring it to the

If you have such, put them up to our engineering department and take advantage of their 33 years of experience. Perhaps we cannot help you. If we can't, we'll be quick to say so.

F.J. STOKES MACHINE COMPANY

Makers of Process Machinery Since 1895

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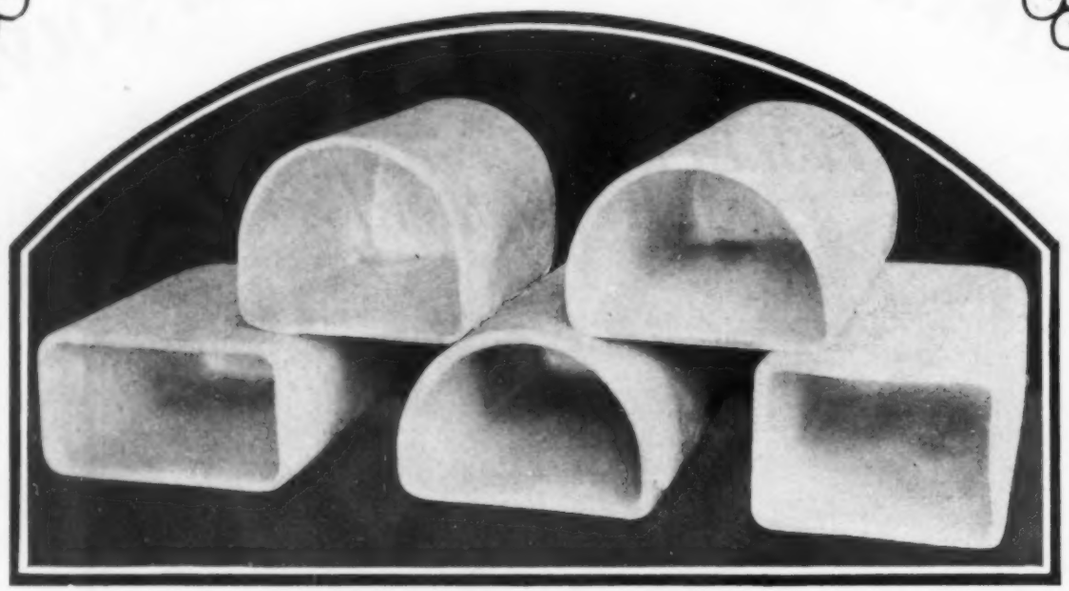

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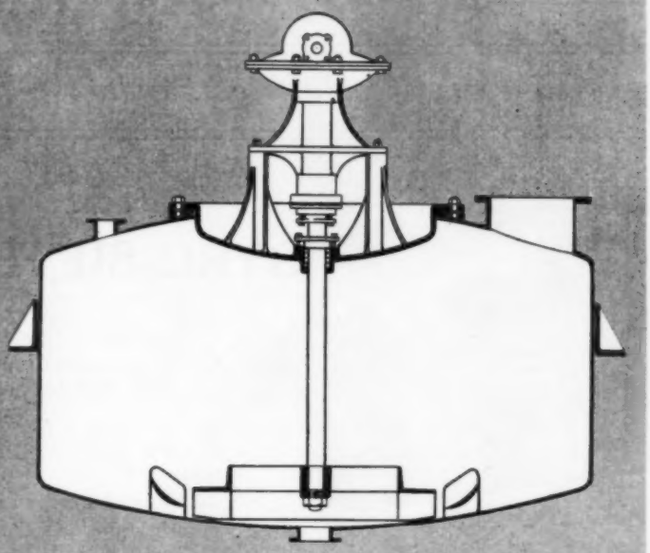
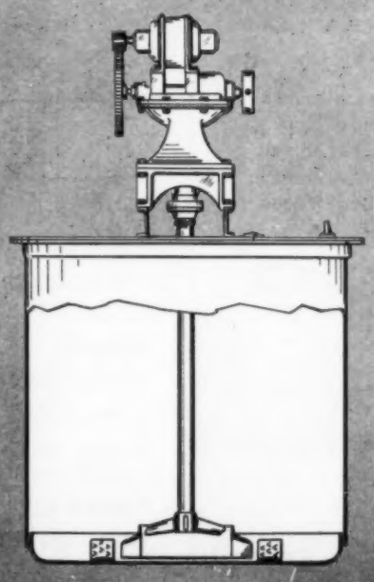
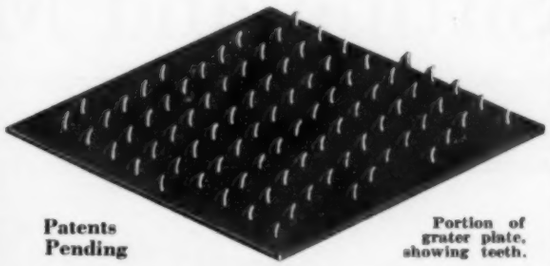


"Johnson" Rapid Turbo-Dissolvers consist of a closed type impeller, a deflecting blade ring with grater plates and a tank designed to give maximum circulation of the entire contents. The grater plates provide simultaneous shredding and dissolving action, hitherto unknown.





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Portion of grater plate, showing teeth.

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Shredder plates with 27,000 teeth on the deflecting blade ring

1. **Present ever fresh contact surfaces between solid and solvent;**
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Equally well adapted to high or low viscosities, for the rapid solution of solid organic or inorganic chemicals in any solvent . . . salts, acids, bases, esters, gums, shellacs, nitrated cotton, etc.

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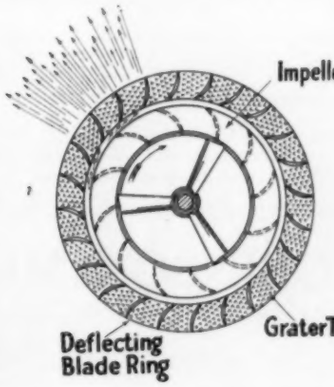

Plan of impeller and deflecting blade ring showing tangential discharge radially deflected.

⊕ 3113

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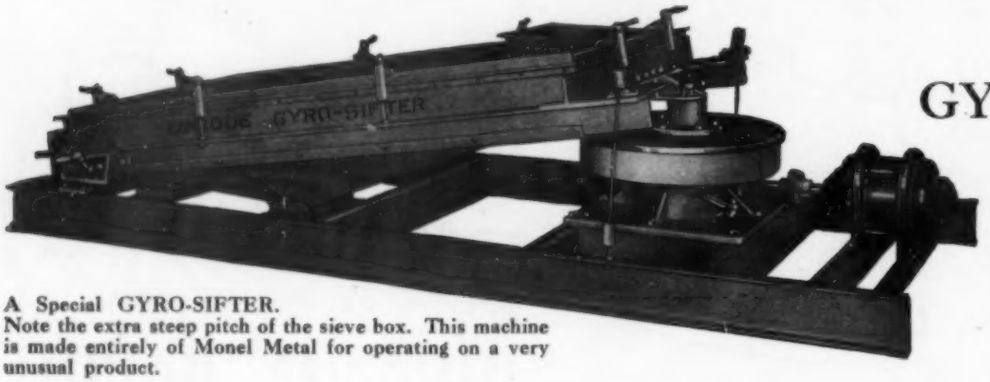
Sifting and Mixing Equipment

Two Important Steps in the Manufacture of Industries' Products



A Special GYRO-SIFTER.
Note the extra steep pitch of the sieve box. This machine is made entirely of Monel Metal for operating on a very unusual product.

The GYRO-SIFTER

Now operating satisfactorily on a multitude of materials and has an unlimited scope of possibilities for practical application. It is furnished standard of steel or wood, in a number of sizes in 1, 2, 3, or 4 sieve deep styles, and any style and size can be readily altered to meet unusual conditions and requirements.

The patented-ball cloth cleaning arrangement keeps the cloth meshes perfectly clean for constant uniform separations, and insures maximum capacity at all times.

Bulletin No. 41-A describes The GYRO-SIFTER fully. We will send it, on request.

UNIQUE MIXERS

Many Types — Many Sizes. Capacities range from ½ to 160 cubic feet. Used for mixing dry, damp or free flowing wet materials and liquids.

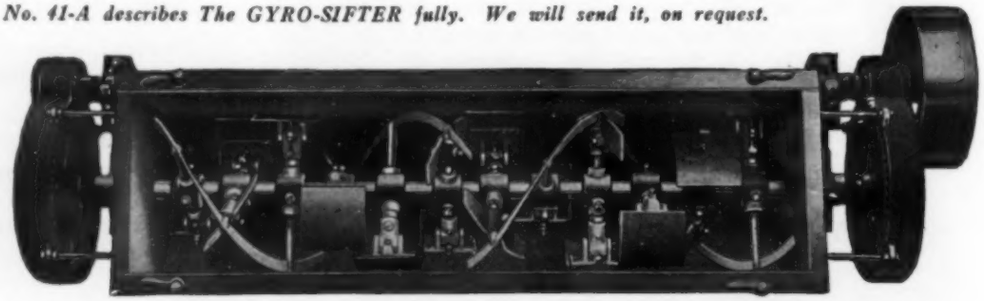


Illustration shows the mechanism of our new "patented" mixer with trowel type mixing blades used for intimately associating materials that would have a tendency to lump or ball up while being handled in the ordinary type of mixer. It has solved the mixing problems in a great many plants handling materials such as, dry colors, water paints, stucco preparations, clays, pulverized sugar, cocoa, soda, etc.

We manufacture mixers with Steam Jacketed Body for heating, boiling or drying the products during the process of mixing. Also mixers with bodies of wood, Monel Metal, or other specially treated corrosion-proof material for mixing salt, chemicals and other products which have a tendency to corrode plain steel.

The combined UNIQUE and GARDNER lines present a suitable Mixer for every requirement. Write for Bulletin No. 32-A of UNIQUE Mixers and Catalog No. 15 of GARDNER Mixers.

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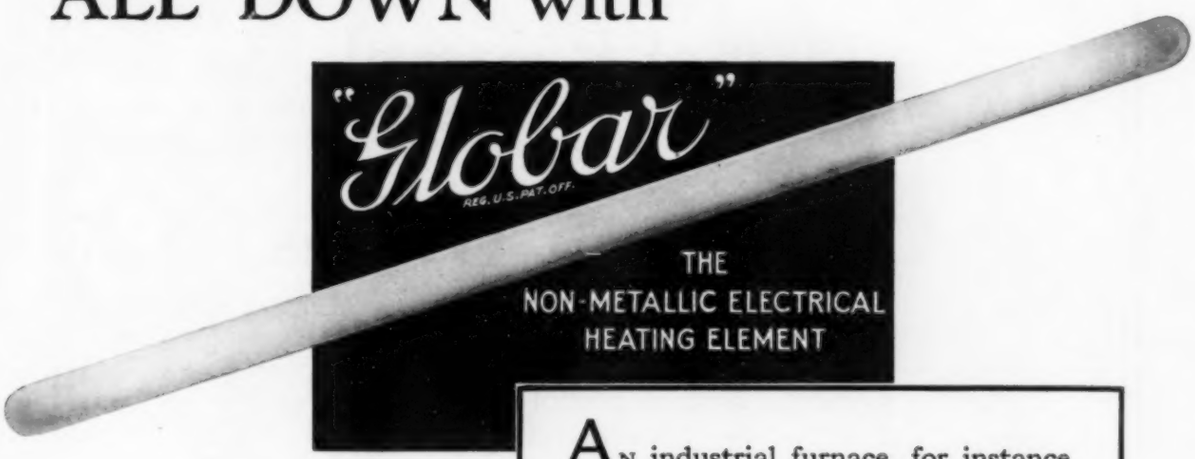
Ask for Catalogs

IT isn't a case of one down— ALL DOWN with



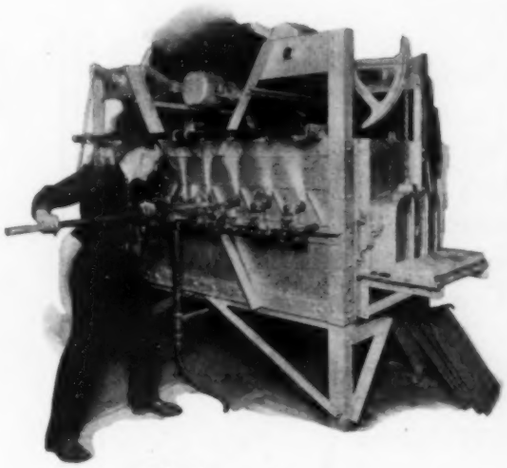
AN industrial furnace, for instance, having a number of Globar heating elements—

¶If it becomes necessary to replace a single Globar the furnace needn't be shut down—there need be no loss of production service—no waiting for the furnace to cool off to get inside to replace the element—

¶No waiting for it to get up to heat again—Globar with its butt-end contact permits of an exceedingly simple mounting—

¶A Globar element can be replaced while the furnace is in operation—and inserted from the outside—

¶It is just a matter of a few moments —and all done while the rest of the Globar elements are at required heat.



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GLOBAR *Has Many Other Advantages*

ALL TOLD IN OUR TECHNICAL BULLETIN D-2

GLOBAR CORPORATION, NIAGARA FALLS, N. Y.

(Globar is the registered trade name given to non-metallic electrical heating and resistance materials, and to other products of Globar Corporation, and is its exclusive property.)

Phenol Removal
from
Coke Plant Wastes

THE problem of phenol removal need no longer vex operators of by-product coke and gas plants. The old steel-corroding, coke-deteriorating method of using phenol bearing wastes to quench coke is no longer necessary.

The Koppers Construction Company announces a perfected process to strip phenol from coke plant wastes. The process has been carried through laboratory and plant size tests by The Koppers Company and is now in actual successful operation at the coke plant of the Hamilton Coke and Iron Company at Hamilton, Ohio.

Through the courtesy of the Hamilton Coke and Iron Company, we invite . . . visitors to inspect this plant . . .

The Koppers Construction Company

Designers and Builders of
BY-PRODUCT COKE AND GAS PLANTS

Chicago Pittsburgh New York

IN PHARMACEUTICALS

The Leading Manufacturing Plants testify to "Barnstead" Efficiency— its Aid in Bettering Products

When Sharp & Dohme needed water for Solution S-T-37 their specification read: "Barnstead distilled"

The Barnstead Automatic Water Stills shown in these two views, furnish the distilled water for Solution S-T-37 at Sharp & Dohme, Manufacturing Chemists, Baltimore, Md. The Barnstead installations at this model plant consist of two Steam-Heated Stills respectively of 30 and 50 gallons distilled water hourly capacity, a Box-type Distilled Water Storage Tank of 270 gallons capacity, and two 150-gallon All-Metal Cylindrical storage tanks.

REPUTATION for "quality of products" is jealously guarded by the leading manufacturers of Pharmaceuticals, Toilet Preparations, best Soaps, fine Chemicals, etc. Their leadership—prestige—business—all are built upon this policy, rigidly adhered to.

Their "BARNSTEADS"—whether employed for small-capacity requirements in Research and Plant-Control laboratories in order to ensure accuracy of determinations, or for factory-scale use to provide a basic ingredient of their products—always can be depended upon to produce exactly the right quality of distilled water to meet their highest-quality standards. A distillate that invariably is *chemically and bacteriologically* pure! And trouble-free operation that is insurance against costly interruptions to Production schedules!

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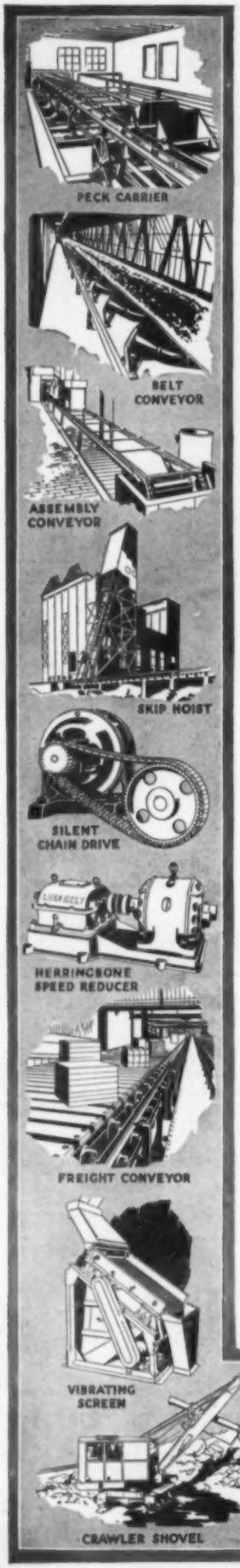
Only distilled water is chemically pure



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All materials, fine or coarse, light or heavy, seem to yield themselves to the wizardry of this screen, and classify themselves in strict accordance with their size.

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VOLUME THIRTY-FIVE - NUMBER TWELVE

DECEMBER, 1928

S. D. KIRKPATRICK, *Editor*

The Individual Basis of Prosperity

DECEMBER finds most of us in the process of inventory and appraisal. This year the annual period of stock taking comes at a time of unprecedented prosperity in American business as well as in the affairs of our national government. In both industry and nation, the elements of this prosperity are the same. It rests with the attitude and achievement of the individual. His confidence in business institutions, his willingness to carry his share in the maintenance of the common good, his insistence on higher standards of living and mental development—have made us a nation in which material progress is inevitable.

PRESIDENT COOLIDGE, in his annual message to the Congress, points with justifiable pride to the phenomenal advance this country has made in the accumulation of wealth. During the past eight years the national income has increased nearly 50 per cent until it is now estimated at more than ninety billions per year. The national debt has been reduced by a third. Four successive revisions in the internal revenue system have each stimulated business so that taxes, even though reduced, have yielded sizeable surpluses. In national government we have seen "substituted for the vicious circle of increasing expenditures, increasing tax rates and diminishing profits, the charmed circle of diminishing expenditures, diminishing tax rates and increasing profits." Applying a comparable cycle in the conduct of private enterprise has helped to dispel the plague of the so-called "profitless prosperity."

AMERICAN business has a competent spokesman in Secretary Mellon and his annual report is a model accounting, not only of governmental finance but of underlying conditions in industry and trade. He finds that business volume for the fiscal year ended with June had declined three per cent below 1927. Profits in manufacturing and mining were also lower by seven per cent but for other industries they were four per cent higher. Since June there has been a more favorable trend. Employment, according to the National Industrial Conference Board, is highest since April, 1927, and wage earnings for 1928 will average greater than for any year since the inflation of 1920. With increased production efficiency reflected in lower commodity prices, the economic status of the worker is better than at any time in history.

BUT from the standpoint of the individual, the process of accounting and appraisal is incomplete if directed solely to material gain. The President defined the chief purpose of government "to keep open the opportunity for a more abundant life." Great resources have been provided, he maintained, primarily to enlarge our intellectual, moral and spiritual horizons. Therefore, as we look forward to plans for 1929, it is appropriate that we make sure of our objectives and if necessary revalue them in other terms than those of profit and loss. Prosperity becomes a tottering structure unless built on the confidence, courage and achievement of the individual.

A New Tariff in the Making

IMMEDIATELY following the opening of the present short session of Congress, the majority leaders of the House Ways and Means Committee outlined a comprehensive program of tariff revision. Such prompt action is encouraging to those of our industries that seek relief in this direction, for, at best, tariff making is a slow and uncertain process. It remains for the industry, through its organized agencies or as representatives of individual enterprises, to present its case so clearly and effectively as to avoid needless controversy and delay.

It will be recalled that when the last tariff act was framed, world commerce in chemicals and allied products was in a chaotic condition. Foreign currencies had not been stabilized and the various nations were intent on developing chemical industries for reasons of military preparedness. Congress found it impossible to secure reliable information on foreign costs or prospective competition and as a result the original hearings that were held in January, 1921, were followed by twenty-one months of negotiation, debate and compromise before the Fordney-McCumber Act finally became a law. Fortunately, most of the uncertainties of eight years ago have now disappeared and, through the efficient work of the United States Tariff Commission and the foreign trade commissioners of the Department of Commerce, the Congress now has accurate and comprehensive information in regard to chemical industry in the United States and abroad.

That a large percentage of the cases in which the flexible tariff has been invoked has been of a chemical character is the best evidence of the need for revising and correcting inequalities in these schedules. To contribute constructively in this program, the chemical industry should arrange immediately to supply the chemical sub-committee of which Congressman L. H. Hadley of Washington is chairman, with complete and convincing data on its tariff problems.

A Change in Status for Muscle Shoals

WHEN the disposition of the federal properties at Muscle Shoals once more comes before Congress for consideration, as is likely during the present short session, it is earnestly hoped that legislators will start with a clean slate and take cognizance of the profound change in the nitrogen situation in 1928 as compared with the war year of 1918.

In 1918, byproduct coke ovens supplied 78,000 short tons of nitrogen, and there was no production of ammonia by direct synthesis. Production in 1918 was, therefore, 54 per cent of the U. S. Ordnance Department's estimate of a war requirement of 144,000 tons of nitrogen per year, and including the Muscle Shoals cyanamide plant, capacity was 118,000 tons of nitrogen, or 82 per cent of war requirement. Clearly, the Muscle Shoals plant was potentially an important factor in nitrogen supply in 1918, and despite the fact that practically no nitrogen ever was produced, it cannot be denied that this project served a useful purpose merely as a safeguard against a possible blockade of Chilean nitrate. In 1928, it must be recognized that the nitrogen situation is far different. It is estimated by competent authority that in 1928, byproduct coke ovens will produce 160,000 tons of nitrogen and that there will be produced by direct synthesis 24,000 tons of nitrogen, a total production of 184,000 tons, which exceeds war requirement by 28 per cent. But most significant, however, is the fact that we are now on the threshold of a marked expansion in nitrogen production, particularly through the ammonia synthesis. It has been estimated that the annual capacity of byproduct coke ovens as of January 1, 1929 will be at least 190,000 tons of nitrogen, and further that before the end of 1929, the capacity of direct synthetic ammonia plants will be 107,000 tons of nitrogen, or a total capacity of 297,000 tons of nitrogen, which is more than twice war requirement. Perhaps the most significant aspect of the present situation is the fact that in this country the ammonia synthesis is now developed to a stage where practically unlimited expansion of plant is an assured possibility. That is, the domestic nitrogen industry is now in a position to meet any requirement for nitrogen including the requirement of war, without dependence on the Muscle Shoals cyanamide plant.

Coke-Oven Gas for Ammonia Manufacture

IT HAS BEEN said many times that the commercial problem of ammonia synthesis is largely one of hydrogen production. The feasibility of coke-oven gas as a source of hydrogen has been the subject of much academic study in this country and abroad, and in July 1926, *Chem. & Met.* published a thoughtful analysis of this problem by Barnett F. Dodge, then of the Fixed Nitrogen Research Laboratory. It has remained, however, for the European industry to carry the project into large-scale production. That this technical development is an achievement of considerable merit is indicated elsewhere in this issue in a paper presented at the recent Bituminous Coal Conference by F. A. F. Pallemaerts, manager of the research division of coke ovens and synthetic ammonia of the Union Chimique Belge.

From the viewpoint of the American coke producer it should be pointed out, however, that this method of manufacture of ammonia is not likely to prove attractive. In the first place it would put the industry into direct competition with its own byproduct ammonia. Secondly, at best but a small part of the industry could take advantage of the process since the largest of the American byproduct coke plants, that of the Carnegie Steel Company at Clairton, Pa., could alone produce more than 1,500 tons of ammonia per day—an amount which under present conditions could not be expected to be absorbed by the world markets.

From the standpoint of the American nitrogen industry, it is only fair to point out that conditions in Belgium and in the United States are radically different. In this country coke-oven gas in recent years has become a byproduct of considerable value and many coke plants have been built primarily to supply city requirements for manufactured gas. In Europe generally, however, coke-oven gas is sold at approximately the same price as the thermal equivalent in the form of coal. Thus, according to Mr. Pallemaerts, with coke at $4.26 and coal at $4.71 per ton of 2,000 lb., coke-oven gas is sold at approximately 11 cents per M. cu.ft. In the United States, however, it is a most unusual condition for

coke-oven gas to be sold for less than 25 cents per M. cu.ft. and twice that figure is not uncommon.

A comparatively simple calculation definitely shows that under American conditions coke-oven gas cannot be considered a low-cost raw material for ammonia synthesis. Allowing for losses in process and purification, 1 lb. of ammonia requires approximately 100 cu. ft. of raw coke-oven gas. Charging only 30 per cent of the heating value of this gas to ammonia manufacture, which is the procedure of Mr. Pallemaerts, the cost of coke-oven gas in the United States per pound of ammonia is 0.75 cent. With a coke price at the oven of $3.50 per ton of 2,000 lb.. which is reasonably comparable with coke-oven gas at 25 cents per M. cu. ft., and allowing 2 lb. of coke per pound of ammonia, which is a generally accepted figure when ammonia is made from water gas, the coke cost per pound of ammonia is 0.35 cent. To this must be added the labor and other costs of manufacturing water gas. Thus it is apparent that in the United States a wide spread exists between these two sources of hydrogen.

As Mr. Pallemaerts observes in his article, the costs in the plant at Ostend are not universally applicable. In addition to the difference in value of coke-oven gas, his figures must be considered in the light of far lower wage rates in Belgium, which reflect themselves not only in direct labor cost in ammonia manufacture, but in the cost of maintenance and in the investment of fixed capital upon which depreciation and other capital charges must be made.

Private Exploitation of Government Research

WHO OWNS the results of government research? This is a very important question to be considered by industrial executives, especially in the chemical engineering industries. The critical nature of the situation is disclosed by the conference held only a few days ago in Washington to consider the meaning of the law passed at the last session of Congress granting commercial patent rights to government employees whose researchs lead to patentable inventions or discoveries.

Apparently the present law gives any government investigator the right to obtain a patent without fee as a result of his research, even though the work be done with tax payers' money and on specific assignment as a part of his official employment. Thus, if an engineer be engaged to develop a new device, to study methods of purification of certain products, or to investigate wastes or industrial processes, he is at liberty, we are advised, to take a patent on the results of his work, and then exploit it for his personal profit without any official supervision.

Elsewhere in this issue is a news report of the conference at which this matter was discussed before a group of research executives and patent counsel of outstanding American corporations. That conference was not in a position to take official action at its meeting, but it did disclose the far-reaching importance of the recent law, and the dangerous situation which has grown up affecting this phase of co-operation between industry and government.

Over a period of years *Chem. & Met.* has taken the stand that the results of invention and discovery made by government employees are and should be public property. No legislation can change the moral right of all industries alike to profit from valuable discoveries made by the government or its staff. *Chem. & Met.* sees in the present situation, and in the discussion of it by competent attorneys and research leaders, no ground for changing this opinion. We see no reason why the government research man should be allowed to develop for his personal profit the results of official investigation done while an employee of the government any more than we believe such a right should be given to the employee of any private corporation.

The very fact that there is uncertainty in the significance of the present law is perhaps the most dangerous factor of all. Law which is ambiguous in so vital a matter as property right in patents cannot be regarded as anything but a threat against the security of the industrial enterprises affected.

Easy Plans Are Difficult to Draw

THERE seems to be something of art in engineering, although few engineers, like Leonardo, go to the length of merging the two completely. Nevertheless, the subtle skill that marks the master of the brush sometimes finds its counterpart in the neat expedient which, like in art—or in golf—permits attainment of an end in the least possible number of strokes. Complex solutions to problems of engineering are cheap. The easy, invisibly obvious answer is at a premium.

Friederich Bergius was in the midst of a talk, a few days ago at the Chemists' Club, about the important work in which he has been engaged for the last fifteen years. He happened to bring in one such expedient, one that was new to his audience, and presumably new to this country. It was only a step in a still obscure process, but it is not unreasonable to believe that it made a deeper impression on some of his hearers than all he had to say about Berginization.

During the war, Bergius and his associates attempted, not without success, to eke out Germany's ebbing supply of carbohydrate foods, by hydrolyzing cellulose to sugars. It was not long before the yield had been improved over that of the original American experiment and the process was ready for the plant. Here, however, the troubles began. It was necessary to use concentrated hydrochloric acid for the hydrolysis, and then to recover it, without the use of excessive heat, in a still concentrated condition. Obviously, vacuum distillation was called for. This brought up the question of heat transfer at the low temperatures that must be used. It was quite out of the question to obtain suitable transfer through the type of materials that were available for use with HCl.

As Bergius modestly said, the simplicity of the final solution to the problem made it remarkable that no one had thought of it before. If simple solutions were easily or frequently arrived at, geniuses would grow on every bush. What could have been easier than to use an immiscible fluid, that was unattacked by the acid, as a heat carrier? And what less likely to be thought of? When it was tried, a hot petroleum oil similar to fuel oil was found to work perfectly. It was only necessary to spray the oil into a mist of the mixture to be distilled, within the vacuum vessel, and the problem was solved. The separation of the glucose and oil and the proper condensing of the evolved vapors presented no difficulties, once the means of effecting the distillation had been discovered.

Raw Materials Control Facilitates Carbon Products Manufacture

By R. S. McBride
Assistant Editor, Chem. & Met.

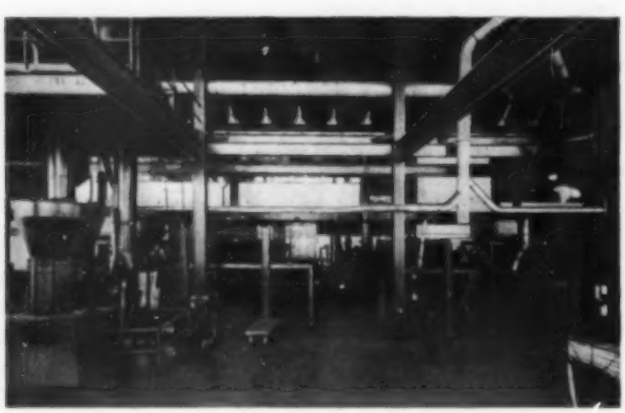
Lampblack Plant at the Fostoria, Ohio, Works of the National Carbon Co.

CARBON products manufacture requires a proper raw material blending, accurately controlled processing, and highly specialized mechanical technique in finishing in order that the final result may be a carbon exactly suited to the user's needs. There are infinite varieties of real or imagined needs among users; hence the manufacturer must know just how each change in raw material or in process technique affects the finished product in order that he may make each lot of the desired mechanical, chemical, and electrical characteristics.

It is not feasible to present here any comprehensive view of the selection of materials or details of plant operation; but it is worth while to study some of the fundamental principles that enter into carbon products making with a view to possible adaptation of these principles to other chemical engineering industry. At the Fostoria, Ohio, works of the National Carbon Company one finds a complete and comprehensive plant, including all auxiliary facilities, even those which have to do with the making of raw materials.

The principal starting materials in this works are crude coal tar from which pitch, tar oils, and other products are made; petroleum oil, from which lamp black is prepared; and the several varieties of artificial and natural graphite, retort carbon, and petroleum coke, which enter into carbon mixes.

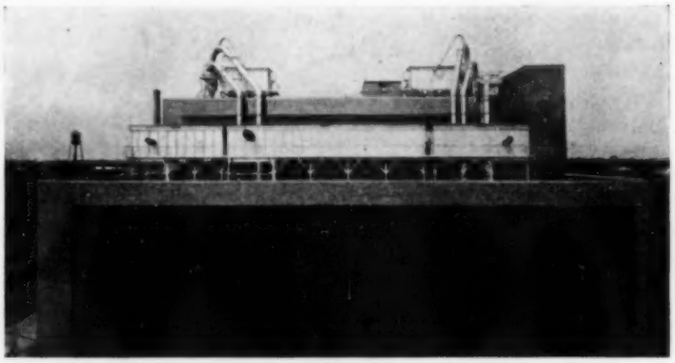
It may seem strange that a carbon products manufacturer should make his own tar products. However, it has been found by experience that it is vital for these tar products to be exactly uniform in character and of absolutely reproducible performance. There are two most important forms of refined tar; one is used for projector and arc carbons and the other for brush-block manufacture. Even though it may require extra plant effort to make them in the carbon plant, it is found worth while to do this, because what might seem to the tar



View of the Ground Floor of the Lampblack Plant Where the Mills Are Situated

Carbon Mixers for Intimate Mixing of Carbon Flour and Pitch at Elevated Temperatures

refiner a negligible variation could produce serious consequences in the characteristics of the final carbon product. The extra complication in manufacture of the tar derivatives used in blending is negligible as compared with the potential difficulty with carbon products through faulty performance if made with improper pitch or tar oil.



Dust-Recovery Systems on the Roof of the Milling Building

Similar importance attaches to the manufacture of carbon flour. In order to have the several forms of this exactly what is wanted, the company finds it advisable to start from crude cokes and the original petroleum oil, making its own lampblack and calculating the cokes in its own plants, accurately to meet the carbon works needs.

Four principal groups of products are made at the Fostoria works: Extruded electrodes and other rod-like products of small diameter, projector and other carbons, both cored and solid, "therapeutic" carbons, and brush block. Some are extruded products, some are die-press formed, and some may be either extruded or die pressed. In each case the starting material is a carbon or mixture of carbons which has been appropriately tempered with tar or pitch before forming. The handling of the various raw materials up to the stage of mixing for the various products is shown in the raw-material flow sheet of the plant.

Coke electrodes, as their name implies, are made with coke as the principal source of carbon; they are the lowest-grade least-expensive form and are, of course, chosen whenever applicable satisfactorily for the purposes of the carbon user. In the manufacture of coke electrodes the process is essentially mixing of finely ground coke with pitch, blending at appropriate temperature, and extruding or pressing hot. The result is an electrode of approximately the desired size in the "green" condition; this is baked for elimination of the volatile content and then finished accurately to size and shape.

Crude coke as purchased is first calcined in a vertical fire-brick retort which is natural-gas fired, after which it is cooled and stored until wanted. It is ground in a mill with air separation and with use of a dust-recovery system to prevent dust losses. The carbon flour is mixed with the requisite quantity of crushed pitch and blended in a steam-heated or electrically heated device at a temperature appropriate to produce thorough coating of every carbon particle with the melted pitch.

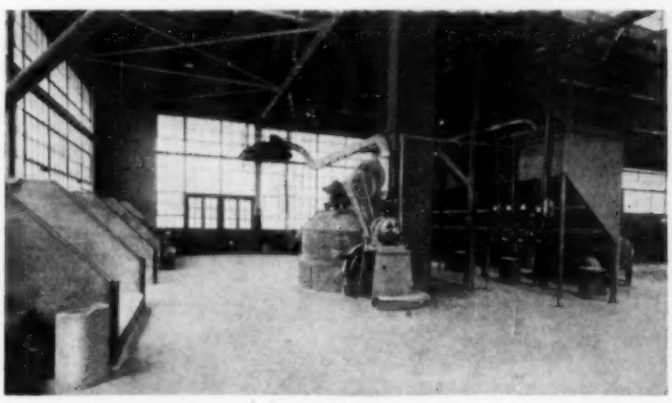
The hot blended mixture is pressed into large slugs of a size suitable for feeding the extruding presses. These are hydraulically operated, using water as the press medium up to several thousand pounds per square inch. As the carbon rod extrudes from the press it is cut by hand into convenient lengths, allowed to partially cool on wood trays, and then cut by machines to appropriate size, each piece to make a single finished electrode or arc carbon or some convenient multiple of this length.

The green carbons at this stage are placed in gas-fired batch furnaces carefully held in place with packing material and baked. The baked rod is cleaned from adhering packing material, sawed with carborundum saws exactly to length, and ground on high-speed grinders accurately to diameter. The grinding element in this grinder is a carborundum wheel and the work is held on this wheel by a second non-abrasive wheel which, although of carborundum, does very little cutting.

The products of this group include a wide variety of carbon rods and shapes, the most important single item being dry-cell electrodes. Such electrodes as are to be used in dry-cell manufacture must be impregnated with paraffin; they are then ready for shipping to the battery plant.

Projector and arc carbons are made by very similar succession of operations to those involved in electrode manufacture. The appropriate mixture of carbons in the form of flour is blended in a steam-heated mixer with pitch or tar. The mixture is put through rolls in order to eliminate any lumps of unblended carbon and then sent while still hot to the extruding presses. The extruding gives either a solid rod for the ordinary type of arc carbons, or a hollow rod for those special carbons in which the core material is to be inserted. The green rod stock is baked in saggers just as brush-block stock is handled.

The baked stock is cleaned, cut to the desired lengths, and the core, if any, is inserted. This core material is a mixture of rare-earth fluorides or appropriate metallic oxide which must be rebaked at a low temperature in a batch furnace after being pressed into the hollow center of the carbon. The pointing, butt-end finishing, and electroplating, if necessary, completes the carbon. The cored carbons are given a special test in order to indicate imperfections or discontinuities in the core. This is essential because if there be an imperfect core it interrupts proper functioning of the carbon and the arc will go out.

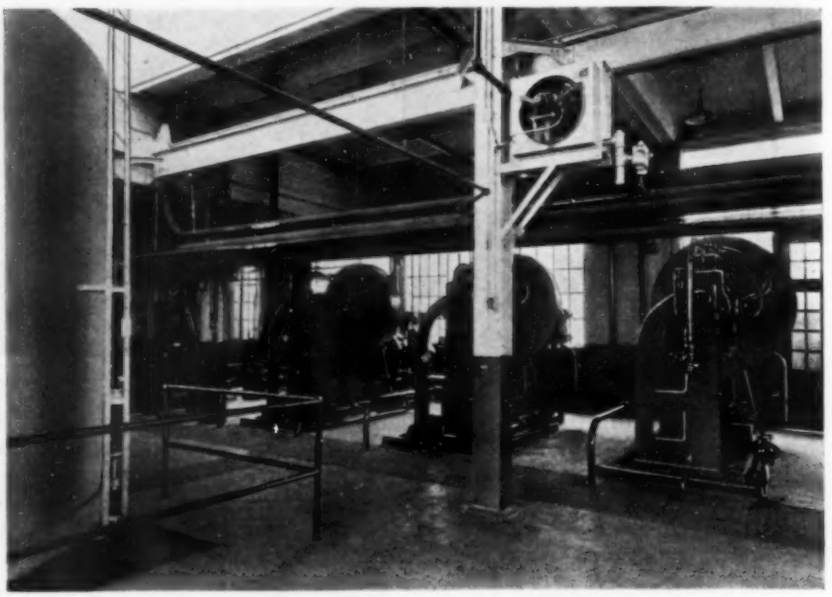


Sagger Material Preparation Equipment is Used at the Fostoria Plant

Carbon brush stock manufacture requires the greatest care and exactness of control of any of the regular major products. Brush block is made from a mixture of carbons blended in the form of flour in proportions estimated to give exactly the desired brush property. Because of the multiplicity of forms of carbon and the variations from one lot to another

of carbons apparently identical in properties it is necessary to use special precautions in mixing of carbon flours; hence, to produce any particular desired performance characteristic in the finished brush, each batch of carbon mixture must be proportioned with great care in the weigh larry. The individual batches vary in size up to a maximum of four tons each.

The carbon is handled from the weigh larry through a mixing system in which the dry cold carbon is blended to form a perfectly uniform mixture. When mixing is completed and it is known that the batch is of the desired composition there is added in the batch larry the desired amount of pitch and a small quantity of oil which serves as a mix lubricant to aid the working of the dies. The blending of the carbon with the pitch is then carried out in a heated mixer. As elsewhere in this very modern plant great pains have been taken to insure that the most effective and convenient equipment be developed to permit maintenance of requisite temperature for this operation with a minimum of energy consumed.



Three Water Pumps Used to Maintain Pressures up to 3,500 lb. per sq.in.; and the Accumulator (at left) Affords Volume Change Without Pressure Deviation on High-Pressure Water Supply

After thorough blending of the pitch and carbon the batch is ground in a ring-roll mill with cyclone air separator and dust collector. This material-handling system of the new plant was designed by the company itself.

The ground mix is formed either in a hand-operated batch press or an automatic power press at a pressure which varies with the product wanted. In the new plant it has been found that one man can do approximately as much work as four men each with the older equipment. The product of the pressing is known as "green" brush block. This block is placed in clay saggers with packing material and baked in a producer-gas fired ring furnace. The cycle of operation of this furnace is such that it is from eight to nine days from the time any section is charged with cold saggers until the next charging of the same section with cold saggers.

The baked brush block may require an additional high-temperature rebake if the brush characteristics wanted include hardness with lowest electrical resistance. This rebake is carried out in an electric resistor furnace in which the group of brush blocks itself forms the resistor.

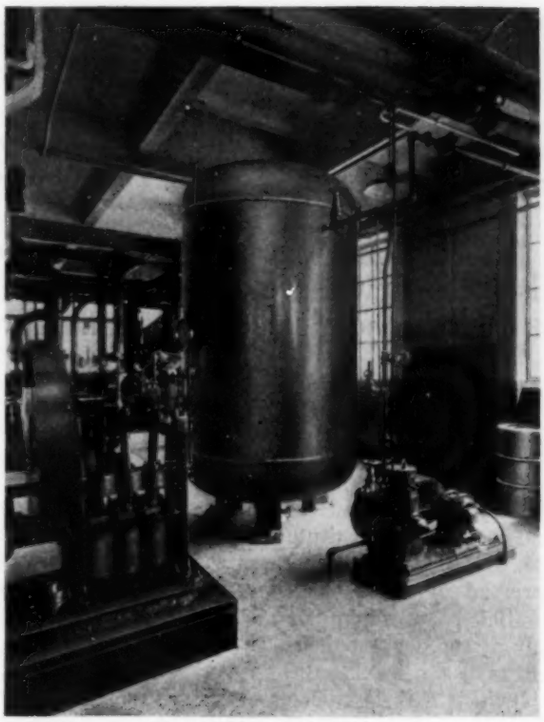
When cold the rebaked brush blocks and that gas-baked brush block which does not require electric-furnace treatment is ready for cleaning and finishing. These operations require merely surface cleaning with an abrasive wheel and accurate sizing in three dimensions with the formation of plane faces, all dimensions complying with the Power Club specifications and tolerances. The properly sized block is finally tested for density, mechanical perfection, and electrical resistivity. It is then packed and shipped to the brush manufacturing plant, where it furnishes the raw stock for the manufacture of all varieties and sizes of carbon brushes.

Material Storage is at the Left, a Sagger Form and Tamping Machine in the Center, a Pug Mill for Wet Grinding of Mixes at the Right, and in the Rear Center is the Sagger Baking Furnace

Most of the carbon specialties go through a very similar succession of operations. Wherever possible the special shapes are made by extrusion but often the desired shape can be prepared only by mold or die pressing. Among the specialties regularly made are telephone disks, lightning arresters, telephone back plates, turbine packing rings, elevator contact plates, and electrical contact points. The business in most of these specialties is, however, not sufficient to justify regular routine operation. They are, therefore, made in a job-order style

so planned as to prevent interruption of the regular functioning of the major part of the plant business. By this means the multitude of customer problems which arise in connection with specials can be given proper attention without interfering with the main plant routine.

Manufacture of big electrodes is not carried out at Fostoria, but it is of interest to compare the procedure at the Niagara Falls and other works making these products with the Fostoria operations on the smaller products. Three important raw materials are used in the making of big electrodes: Anthracite, petroleum coke, and pitch. The composition of the mix is determined by the desired electrical and mechanical properties. Those electrodes which must be rugged for heavy-furnace duty usually include anthracite; those to be graphitized are made from other bases. In general, the electrical properties and strength required govern the type and proportions of the ingredients used.



The High-Pressure Water Supply Pumps and Tank for Feeding Hydraulic Presses

The anthracite used is of buckwheat size, usually well under 15 per cent ash content. The petroleum coke is prepared for use by furnace calcination, either at low temperature in a rotary kiln or at high temperature in an electric furnace. After this calcining for elimination of volatile matter the coke is milled to a carbon flour in a vertical ring-roll mill with an air-separation and dust-recovery system.

The mixture for any type of coke or coal electrode is prepared in heated drum mixers and then cooled to the requisite temperature for hydraulic pressing in a rotary cooler, which is merely a small cement mixer. In this cooler it is rotated with circulation of air over the mass until the temperature reaches exactly the point at which extruding will proceed smoothly. In most cases it requires several mixer batches to fill a large hydraulic press, since the batches are usually 500 to 600 pounds and the presses hold from 2,000 to 12,000 pounds per charge.

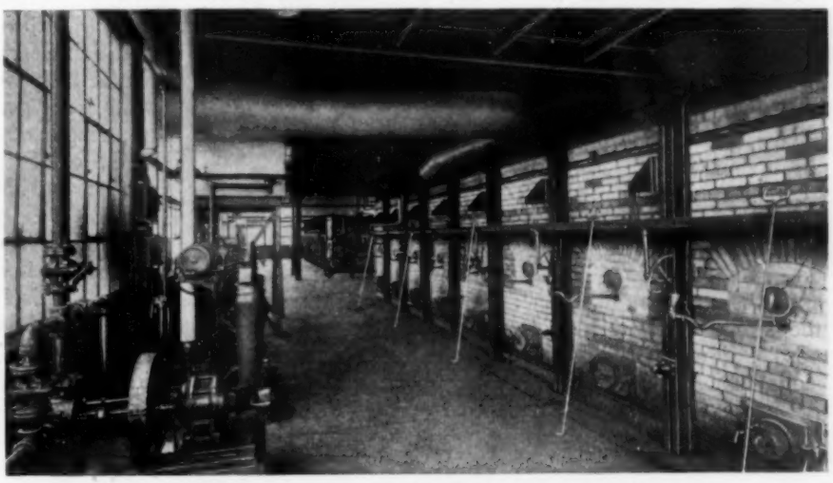
The extruding presses used for the large electrodes are mounted on trunnions to permit tilting. The press chamber is filled while in a vertical position by a chute from the blending and mixing floor. The press is then rotated to horizontal position and the hydraulic extruding ram operated to force the electrode through the die onto the cutting table. Several small electrodes are made from a single press batch; but in the case of the largest size electrodes, 40 inches in diameter by 10 feet long, a full press batch is required for a single finished electrode.

When the electrode emerges from the press die the requisite length is cut off by a double-knife mechanism. It is then quickly rolled down an incline into the cooling tank which contains water at an accurately controlled temperature. The cooled electrode is lifted from this tank by a crane and transferred to the "green" stock pile awaiting baking.

Baking is carried out in large batch furnaces which are ovens fired with either natural gas or oil or in the more efficient natural-gas-fired ring furnace. The electrodes are placed either horizontally or vertically in the furnace chamber and carefully surrounded with packing material which will prevent them from slumping down and distorting under their own weight when heating up begins. This requires not only care in firing, but also careful placing of the electrodes in the furnace. No saggers are used in the baking of large electrodes.

The baked electrode is cleaned for removal of the packing material and is machined to shape if necessary. In many cases simply squaring of the ends suffices. In other cases the ends must be bored and threaded in order to provide for the threaded connector which joins succeeding sections of electrodes used in continuous furnace operation. The machining of all types of electrodes is carried out on lathes and other equipment very similar to the form used in metal working. The problem of tools is, however, a novel one, since the cutting of carbon is very hard on all tool materials.

In the manufacture of the big electrodes at Niagara Falls the control and processing of the raw materials are as important as in the making of the projector and arc carbons, brush block and other small carbon products made in the Fostoria plant. It is very essential in the production of all such carbon products that the raw materials be correct.



View of the Burner Room with the Oil Pumps in the Left Foreground

Looking Into the Future of Coal Processing and Utilization

Second International Conference on Bituminous Coal discloses new developments and indicates importance of chemical engineering processes

Editorial Staff Report

EVERY phase of the Second International Conference on Bituminous Coal, held at Carnegie Institute of Technology Nov. 19 to 24, disclosed the acceptance of the idea which was expressed in the address of welcome by Dr. Thomas S. Baker, president of Carnegie "Tech"—"Coal is not only of the deepest theoretical significance, but in our industrial age is also the most useful of raw materials with which man has been endowed." All important groups interested in coal processing, coal utilization for heat and power, and coal products were represented; but the coal producer was conspicuous by his absence. Apparently everyone else but the coal-mine operator recognized this as an unusual opportunity for exchange of that information which is to guide industrial development during the next few years.

Reporting such a complicated conference, made up of nearly 40 sessions and including over 125 formal papers, within the space of any one magazine is a hopeless task. At best even the person actually present at the conference for the entire week could get but glimpses of the large opportunity which was afforded to American industry through this unusual gathering. This summary is, therefore, a reflection of but a few of the high lights of the addresses and discussion, including, of course, principally those points which appear to have the largest immediate value for the chemical engineer and the process industries. Those who have responsibility for the selection, utilization, or the processing of coal in any branch of business will do well to procure the two volumes of proceedings which are promised for early delivery from the Institute. These two volumes will unquestionably be worth many times their price ($15) as a summary of international opinion on coal and its products.

Chemical engineers were quite at home in most of the discussions which ran throughout the meetings. The influence of fundamental research on all branches of coal was never more conspicuous than in these sessions. Economic considerations were almost equally conspicuous, for in every meeting it was evident that the speakers realized the importance of demonstrating clearly the sound industrial aspects of their technologic proposals. Two of the papers presented at the general sessions which were of outstanding merit in emphasizing economic factors were those presented by F. G. Tryon, of the U. S. Bureau of Mines, who gave a most enlightening statistical interpretation of fuel utilization trends, and the address entitled, "Coal, Hydrogen, and Capital," by F. zur Nedden, of Reichskohlenrat, Berlin, Germany.

The address by zur Nedden left little doubt in the mind of the listeners that two co-ordinate economic yard sticks must be used in measuring the merit of new enterprises and in judging the economic status of all present establishments. On the one hand, there is the ratio of capital investment to value of product. On the other hand must be considered the ratio of value of products to value of raw coal.

Using these two co-ordinates zur Nedden demonstrated the principle which he deems of general application, that—"The higher the quality of the bearer of energy into which you transform coal the greater is the amount of capital which you must invest per ton of annual through-put." He pointed out, however, that there is one apparent exception to this general rule in the case of coal-liquefaction processes. In this group of processes a large increase in product value per unit of raw material value occurs with only a relatively low ratio of investment to material cost. This is as would be expected when one realizes that of all important fuel utilization schemes now common practically none approach at all closely the high capacity-load-factor which appears to be certainly possible in coal liquefaction. High-temperature byproduct coking does have such high load factor, but the capital costs per unit of coal handled are apparently several times as great as are required for coal liquefaction plants.

IMPORTANT aspects of coal hydrogenation for the making of liquid fuels from bituminous coal were presented by various speakers representing British, French, German, and American industrial groups and research institutions. Fundamental studies have been continued very actively in all these countries and experimental results were presented by J. Ivon Graham, of Birmingham, England; J. P. Arend, of Luxembourg, France; Hugel, of Strasbourg, France; Audibert, of Senlis, France; and Messrs. Kling and Florentin, of Paris. None of these workers report commercial developments as yet under way except in Germany, where the Bergius process has been industrialized by the I. G. Farbenindustrie. This German concern has, however, made much progress and is marketing regularly a bituminous fuel oil and its products, which include a gasoline substitute said to be excellent in performance and economically low in price.

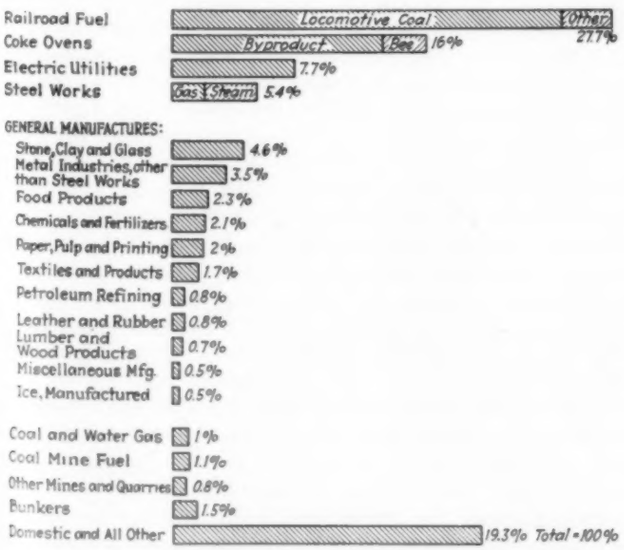
The fundamental work of Friedrich Bergius which led to this German industrial development has been continued with a view to disclosing more of the structure of coal itself. This eminent investigator reported at Pittsburgh the successful completion of his experiments in

the transforming of cellulose and lignin into an artificial bituminous coal by hydrogenation of these vegetable materials under pressure in the presence of appropriate catalysts and at appropriate temperatures. The results of reaction between hydrogen and cellulose are reported to yield an "end coal" equal to about 40 to 45 per cent of the weight of the initial cellulose.

Not only does this artificial coal, when made either from cellulose or lignin, resemble natural bituminous coal in physical properties but, it also resembles it in its chemical behavior. For example, Berginization of this end coal produces oils and chemicals exactly analogous to those made by similar hydrogenation procedures on natural coal. Bergius therefore concludes that we may safely infer that bituminous coal has probably been formed in nature largely from cellulosic materials and that no reactions are required to explain the formation of bituminous coal that cannot be more or less readily duplicated in the research laboratory.

These disclosures of Bergius give us a new understanding of coal structure and more convincing theories as to its origin and formation than appear to have been available heretofore. They also give increased knowledge by which to guide our further experimentation in the use of coal for various types of chemical products manufacture. It appears logical that the half dozen or more other papers presented at the conference on the subject of the origin and composition of coal should all be studied and interpreted in the light of these new conclusions presented by Bergius. The Bergius method of approach is not likely entirely to replace the microscopic and chemical-solvent methods of studying coal structure, but apparently his investigations afford an entirely new method, supplemental to that of Thiessen and other prominent workers in this field.

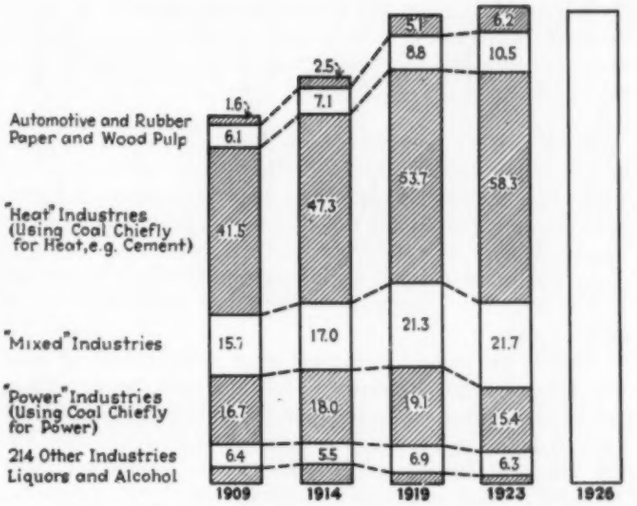
Catalysis as a factor in coal processing received much attention at this Conference. Kling and Florentin, discussing high-pressure hydrogenation, undertook to interpret the fundamental reactions and the influence of physical conditions upon these reactions. They conclude that hydrogenation of complex substances usually requires catalytic agents differing in nature according to the temperature of the reaction.



Consumption of Bituminous Coal by Uses in a Year of Industrial Activity

The data for general manufactures used in preparing this chart represent 1923, the last year covered by the "Census of Manufacturers"; those for railroads, coal-mine fuel, and steel works represent 1926. For the electric utilities, bunkers, and "domestic and all other" 1927 data have been used as being more typical than 1926. The figure for coke ovens represents the total consumed in the active year 1926, subdivided, however, between beehive and byproduct so as to allow for the progress in constructing new byproduct ovens in 1927 and 1928.

Note that the item "domestic and all other" includes, besides houses, the heating of large buildings other than factories, such as hotels, apartments, stores, offices, theatres, garages and service stations.



Consumption of Coal by General Manufacturing Plants (Not Including Steel Works, Coke and Gas Plants)

The "Census of Manufactures" gives the coal consumed in 1909, 1914, 1919, and 1923 by each of 390 industries. The consumption in 1926 cannot be subdivided, but from various indications, the total appears to be slightly less than 1923.

The figures in the bars represent million net tons of coal, including anthracite as well as bituminous. The 390 census industries are here grouped from the viewpoint of fuel consumption. The automotive and rubber, and paper and wood pulp industries are separated because they have been affected by an abnormal growth, and the liquor industry, because it has been affected by an abnormal decline. The group of "heat" industries shows a large increase in coal consumption, the "mixed" industries a smaller increase, and the "power" industries an actual decrease. This decrease is due largely to the shutting down of factory power plants and the purchase of electric central station power.

Another of the reports of outstanding merit presented at the conference on the subject of catalysis was an address by Dr. Carl Krauch. His explanation of catalytic phenomena requires the assumption that an oriented arrangement of the materials which are catalyzed occurs upon the surface of the catalytic agent. Assuming a di-polar nature for certain materials one can account for the lessening of the resistance to breakage of certain bonds in compounds oriented on catalytic surfaces. And the same explanation accounts for the fact that other possible reactions, which according to laws of probability might occur simultaneously, are correspondingly repressed because other structural bonds within the molecules are strengthened by this same orientation of the molecules. Thus one understands why a catalyst may not only aid in the desired reaction, but also actually slow down or altogether suppress an unwanted side reaction.

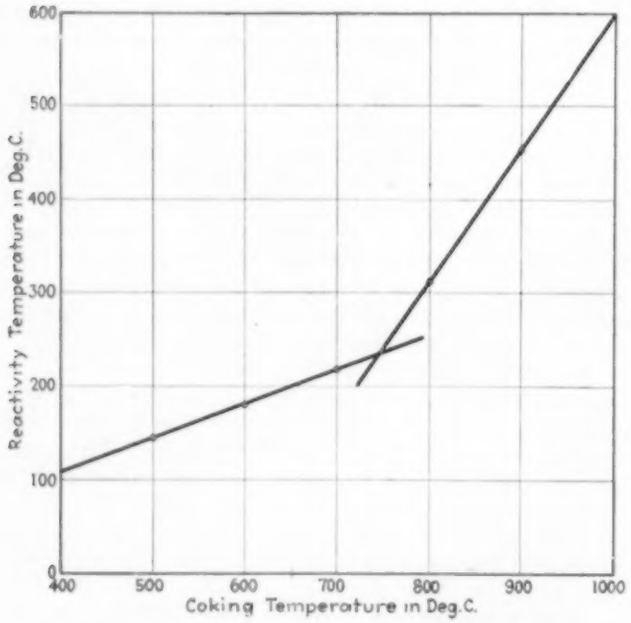
Statistics presented by F. G. Tryon, already referred to, emphasize the very great importance to the process industries of efficient coal burning for process-steam generation and for general heating purposes. This group of industries is, in fact, collectively the largest user of bituminous coal other than the railroads (and electric central stations). Furthermore, it appears that with the continued improvement in locomotive fuel-using efficiency and with the electrification of railways the chemical-process industries are going to take first rank as fuel consumers. In this ranking position they must give increasing attention to questions of powdered-coal firing versus stoker firing of power plants. Especially when such power plants are operating to make process steam

it will not suffice for the industrial management to refer all such problems to central-station operators or merely treat as incidental the question of power-plant equipment selection.

IT IS VERY evident from the diversity of opinion exhibited in the papers dealing with pulverized-fuel firing that the next decade is to see a very vigorous battle between stoker-fired and powdered-coal-fired boiler equipment. It behooves the industrial executive, therefore, to make a careful analysis of his particular situation before committing his company to any new undertakings of either type.

Among the papers presented were several dealing with the fundamental problems which underlie boiler firing. All of these promise to be very valuable to the industrial executive. Among those especially worthy of mention are the contribution of Blythe, Rosin, Kreisinger, and Armour. The experience reported by I. P. Goosens, Aachen, Germany, is particularly significant in suggesting the possibility of long-distance transport of pulverized coal. This engineer has made a very careful cost analysis of the investment requirements and the operating expense for three systems of moving powdered coal.

Present-day power-plant efficiencies do not represent the maximum anticipated for the future, according to numerous speakers at the conference. Professor A. G. Christie, of Johns Hopkins University, undertook a résumé of trends in boiler-plant development and offered very encouraging forecasts. A. R. Smith, engineer of the General Electric Company, outlined the advantages which have been obtained from radically modified equipment, including a new combustion cycle and the investigations of his company on the mercury boiler. Analogous to the latter group of studies a still more radical possibility was forecast by H. C. Parmelee in his address on chemical engineering aspects of coal utilization. He pointed out how the chemical engineer has offered the possibility of new boiler mediums which theoretically afford at least double the present maximum efficiency that is possible within the thermo-dynamic limits of the properties of steam. He referred to those semi-commercial-scale tests which indicate large opportunities in this direction, including the possibility of placing such cheap fuel-electric power plants at points near to the centers of utilization.



Relation Between Temperature of Coking and Activity of Coke Produced

Data by Parr, showing increase in ignition temperature of cokes with increase in maximum temperature to which they have been subjected during manufacture.

Intermingled with these forecasts of radical change were more conservative reports on details of equipment. Among the warnings sounded by the various speakers was that of Estep, who discussed the problem of clinkering of coal ash in relation to mixed boiler fuels. Although stressing the great importance of laboratory tests Estep points out that at the present time it apparently is still necessary to carry out a full plant-scale test in order to determine the desirability of any coal for boiler firing.

Cleaning of coal for a wide variety of uses received serious attention at several sessions. From the chemical engineering point of view one of the most interesting contributions was that of F. W. Sperr, who presented the question as to whether recent developments in the art of gas purification did not make it economically desirable to use a high-sulphur coal in coke and gas works.

LOW-TEMPERATURE carbonization was the subject discussed at the largest number of sessions of any topic considered. However, most of the papers dealt with theories underlying or the construction and operating methods used in particular systems which are now under development. The general address by S. W. Parr was in striking contrast with these, as it dwelt with the fundamental aspects of coal processing and outlined the author's interpretation of the whole phenomenon of coking. Parr pointed out that following the period of drying which takes place up to 100 deg. C. there is the period of coal conditioning during which time the temperature of the coal mass rises slowly from 100 deg. to some temperature above 200 deg., usually above 300 deg., while there are in progress those endothermic reactions which accompany the giving off of carbon dioxide and water. The rate of heating during this conditioning period is shown to be of very great importance, determining not only the temperature at which the exothermic reaction of carbonization begins, but also the character and yield of the products obtained.

Parr also presented data showing how the reactivity of the coke produced varied greatly with the maximum temperature to which it had been subjected during processing. At approximately 750 deg. he finds a sharp break in the reactivity curve, exposure of cokes above this temperature greatly reducing their tendency to ignite. This exposition of Parr's is one well worthy of study by all those interested in any phase of low-temperature coking.

All of the secondary products of coal carbonization came in for their share of attention. Two sessions of the conference got as far afield from coal itself as to give their entire attention to the manufacture of synthetic ammonia and the problems of the fertilizer industry. Among the outstanding contributions of the entire conference was a paper presented at one of these sessions by F. A. F. Pallemaerts, Manager of Research of the Union Chimique Belge. He discussed the production of hydrogen from coke-oven gas and his company's application of the Cassale system of synthetic ammonia manufacture. Pallemaerts' paper is reprinted in extensive abstract form elsewhere in this issue. It is of particular value because of the careful analyses of costs which it presents.

Dehydration of Gas Efficiently Accomplished at Low Cost

By G. A. Bragg
The Koppers Company, Pittsburgh, Pa.

FIGURES for the cost of gas dehydration have been calculated for a typical small gas plant. The figures are given in such a way that it is hoped they can be easily modified to indicate the cost of dehydration under conditions varying from those chosen. The plant has a capacity of 5,000,000 cu.ft. per day of 525 B.t.u. gas saturated at 60 deg. F. and 30 in. The dehydration plant will be located before the holder. The water seal of the holder will be covered with a 2-in. layer of gas oil to prevent resaturation of the dried gas. Cooling water is considered available at 2 cents per M. gal., steam at 50 cents per M. lb., electrical energy at 1½ cents per kw.-hr. On this basis, electric power is charged for at 1½ cents per hp.-hr., which makes an ample allowance for switchboard and motor losses. Each type of plant is assumed to require the same amount of labor, that is, one-half of one man's time for 24 hr. per day at 50 cents per hr.

In the summer time the gas will reach this typical dehydration plant saturated at 80 deg. F. and is to be dried to a dew point of 55 deg. F. The temperature of the available cooling water is 75 deg. F. In the winter time the gas will reach this typical dehydration plant saturated at 60 deg. F. and is to be dried to a dew point of 30 deg. F., cooling water at 40 deg. F. is available. The capital cost and operating charges for three different types of dehydrating plants are given. These are, dehydration with a hydroscopic brine, dehydration by refrigeration using the ammonia compression type and dehydration by compression. The ammonia absorption type of dehydration by refrigeration is ordinarily more expensive than the compression and would be used only where waste heat is available at a normal figure.

Dehydration by compression is prohibitively expensive, unless the compression is necessary for distribution. Assuming that in the first case the gas is already compressed to 15 lb. for distribution and in the second case to 50 lb., our figures show an additional cost for the compression which is necessary to obtain the same dew points as if dehydration with brine or by refrigeration were used.

Under certain conditions dehydration will result in some loss of heating value due to the condensation of some of the constituents of the gas. This loss will be greater in the case of water gas than in the case of coal gas.

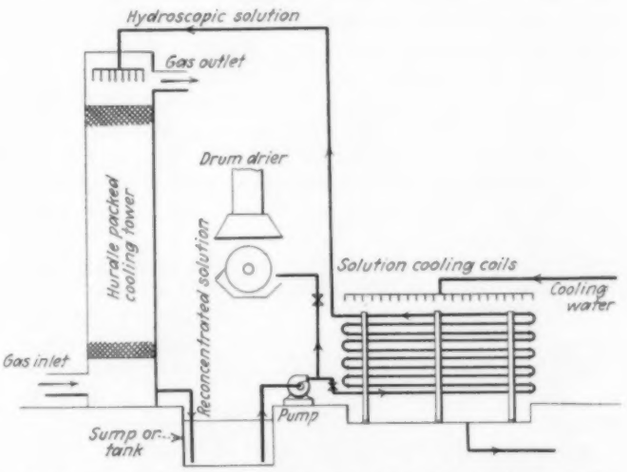
Dehydration with a hygroscopic brine is ordinarily the cheapest and simplest way of drying gas. Sketch No. 1 shows a typical plant. The cost of such a plant complete with foundations and a small building for housing the pumps may be assumed to be about $35,000.

The daily cost of operation of this plant would be as follows:

Labor	
One-half one man's time at 50 cents per hr.	$ 6.00
Power	
7½ continuous horsepower	
180 hp.-hr. at 1½ cents	2.70
Water	
175,000 gal. at 2 cents per 1,000 gal.	3.50
Steam—for Evaporator	
10,000 lb. per day at 50 cents per 1,000 lb.	5.00
Maintenance, Repairs and Supplies	5.00
Calcium Chloride	
14 tons per yr. at $25 per ton	0.96
Fixed Charges	
13 per cent per yr. of $35,000	12.47
Total cost per day	$35.63
Cost per M. cu.ft. of gas	$ 0.0071

In making the above figures calcium chloride solution was used as the hygroscopic brine; this being the solution which is used in England and concerning which considerable data is available. It has been assumed that two complete changes of brine would be required each year. This takes care of losses of all kinds and permits renewal of the solution which will undoubtedly become quite dirty from such long use.

The above costs are for summer operation. During



Sketch No. 1—Plant for Dehydration with a Hygroscopic Brine
The principal pieces of apparatus are: a hurdle packed scrubbing tower, in which the gas is scrubbed with the brine, pumps for circulating the brine over the tower, cooling coils for removing from the brine the heat due to the condensation of the water vapor from the gas, and an evaporator for driving off the condensed water from the brine.

Extracts from the report of Subcommittee No. 3 of the Committee on Dehydration of Gas, presented before the American Gas Association at the annual meeting in Atlantic City, October 8-12, 1928.

the winter the load on the plant would be less because less water has to be removed in drying the gas from 60 deg. F. saturated to a dew point of 30 deg. F. than from 80 deg. F. saturated to a dew point of 55 deg. F. Consequently less cooling water and steam are required and the cost of dehydration is less. This plant operating on gas saturated at 60 deg. F. with cooling water available at 40 deg. F. could actually dry the gas to a dew point of 20 deg. F. at a lower cost than indicated above for summer conditions. The cost of winter operation with a 30-deg. F. dew point would be as follows:

Labor	
One-half one man's time at 50 cents per hr.	$ 6.00
Power	
7½ continuous horsepower 180 hp.-hr. at 1½ cents	2.70
Water	
58,000 gal. at 2 cents per 1,000 gal.	1.16
Steam—for Evaporator	
7,000 lb. per day at 50 cents per 1,000 lb.	3.50
Maintenance, Repairs and Supplies	5.00
Calcium Chloride	
14 tons per yr. at $25 per ton	0.96
Fixed Charges	
13 per cent per yr. of $35,000	12.47
Total cost per day	$31.79
Cost per M. cu.ft. of gas	$ 0.0064

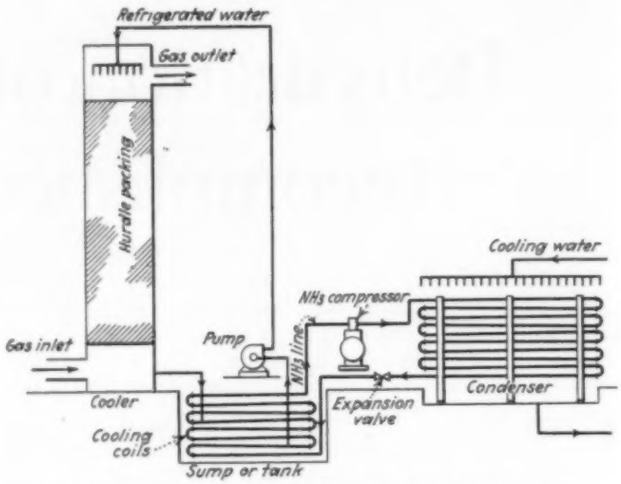
Dehydration by refrigeration involves the use of a refrigerating machine. Refrigeration of the gas may be accomplished by direct cooling with refrigerated water or indirectly by passing the gas through condensers, the tubes of which contain the evaporating refrigerant. No figures are available for the use of these indirect coolers.

Direct cooling of the gas with refrigerated water is very simple. It involves no new or untried types of apparatus. The possible dangers of corrosion which exist in the brine dehydration system are absent. On the other hand, dehydration by refrigeration involves previous substantially complete removal of naphthalene. Further, it is not safe to refrigerate the water which is used for cooling the gas much below 35 deg. F. Consequently, the lowest dew point obtainable with this system is about 40 deg. F., unless the gas is cooled under pressure and allowed to re-expand. In the cost figures no charge is made for the removal of naphthalene previous to dehydration nor is any account taken of the fact that the lowest dew point obtainable is 40 deg. F., whereas this limit does not exist when dehydration is accomplished either with brine or by compression.

Sketch No. 2 shows a typical plant. The cost of such a plant complete with foundations and a building for housing the refrigerating machinery and pumps will be about $40,000.

The daily cost of operation of this plant will be as follows:

	Coal Gas	*Water Gas*
Labor		
One-half one man's time at 50 cents per hr.	$ 6.00	$ 6.00
Power		
45 continuous horsepower 1,080 hp.-hr. at 1½ cents	16.20	16.20
Water		
150,000 gal. at 2 cents per 1,000 gal.	3.00	3.00
Maintenance, Repairs and Supplies	5.00	5.00



Sketch No. 2—Plant for Dehydration by Refrigeration

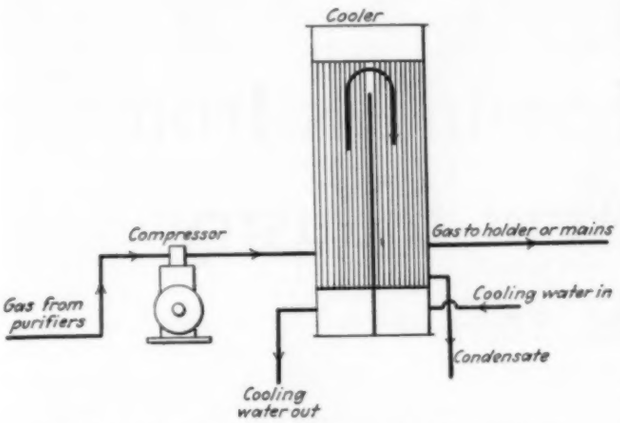
The principal pieces of apparatus are: a hurdle packed scrubbing tower, in which the gas is cooled with the refrigerated water, pumps for circulating the water over the tower and through the pump in which the ammonia expansion coils are located and a refrigerating machine with the necessary auxiliary apparatus, such as condensing, evaporating and cooling coils.

Anhydrous Ammonia		
1,300 lb. per yr. at 14 cents per lb.	0.50	0.50
Condensation Loss		
For water gas only	....	11.42
Fixed Charges		
13 per cent of $40,000	14.25	14.25
Total cost per day	$44.95	$56.37
Cost per M. cu.ft. of gas	$ 0.0090	$ 0.0113

The above costs are for summer operation. During the winter the load on the plant will be less because less water has to be removed when drying the gas from 60 deg. F. saturated to a dew point of 40 deg. F., than from 80 deg. F., saturated to a dew point of 55 deg. F. If this plant is operating on gas saturated at 60 deg. F. with cooling water available at 40 deg. F., it could dry the gas to a dew point of 40 deg. F. at the cost indicated below.

	Coal Gas	*Water Gas*
Labor		
One-half of one man's time at 50 cents per hr.	$ 6.00	$ 6.00
Power		
35 continuous horsepower 840 hp.-hr. at 1½ cents	12.60	12.60
Water		
110,000 gal. at 2 cents per 1,000 gal.	2.20	2.20
Maintenance, Repairs and Supplies	5.00	5.00
Anhydrous Ammonia		
1,300 lb. per yr. at 14 cents per lb.	0.50	0.50
Condensation Loss		
For water gas only	....	11.42
Fixed Charges		
13 per cent of $40,000	14.25	14.25
Total cost per day	$40.55	$51.97
Cost per M. cu.ft. of gas	$ 0.0081	$ 0.0104

An absorption type refrigerating machine may be less expensive that the compression type machine for use in dehydration by refrigeration, if exhaust steam or some other source of heat is available at little or no cost. Of course, this condition rarely exists, but where it does



Sketch No. 3—Plant for Dehydration by Compression
The principal pieces of apparatus in this plant are: A compressor to compress the gas from the purifiers before entering the cooler, pumps for circulating the cooling water through the coils of the cooler, after-coolers and cooling coils.

the indicated cost for dehydration in this way is about the same as that for brine dehydration.

Many operating companies already obtain some dehydration by compression. Dehydration to the dew points specified, where compression serves no other purpose than dehydration, is more expensive than the other methods. Where some compression is necessary for distribution, dehydration may often be reasonably obtained by an increase in the pressure to which the gas is compressed. The cost of this additional compression has been calculated for the case where the gas is compressed to 15 lb. for distribution in both summer and winter seasons. For summer conditions in a typical plant, it is only necessary to compress the gas to 21½ lb. gage, that is, gas entering the compressors saturated at 80 deg. F. and leaving them at the same temperature and 21½ lb. gage pressure will, when expanded to atmospheric pressure at 80 deg. F., have a dew point of 55 deg. F. For winter conditions it is necessary to compress the gas to 33½ lb. gage, that is, gas entering the compressors saturated at 60 deg. F., and leaving them at 60 deg. F., and 33½ lb. gage will have a dew point, when expanded to atmospheric pressure at 60 deg. F., of 30 deg. F. Thus a plant which is already compressing to 15 lb. will have to alter its equipment for compression to 33½ lb. In most plants this will mean new compressors. The cost of such a compressor plant without buildings, but including foundations, is about $40,000. This figure is used for computing fixed charges where gas is already being compressed to 15 lb.

In cases where distribution already requires compression to 30 lb., it is apparent that no additional equipment will be necessary to obtain the compression to 33½ lb., which is necessary for dehydration. Hence, in the cost set-up for these conditions there is no capital cost. In each case cooling water will be required and it is assumed that enough will be used so that the gas will leave the after-coolers at the same temperature that it entered the compressors. The cost of after-coolers is included in the cost of the compressor plant necessary for 33½ lb. compression. It is assumed that after-coolers are already in use in the present 30-lb. compressor plant. It must be continuously borne in mind that compression to the pressures here indicated will result in a final dew point the same as that obtained with the other systems only when the gas is expanded to atmospheric pressure. This compression will not prevent condensation of water in the high-pressure distribution mains unless the temperature in the mains is as high as that at which the gas leaves the after-coolers. This latter is rarely, if ever, the case. It should be further noted that the other types of dehydration plants were located before the holder so that they could be operated continuously at a high percentage of their rated capacity. Ordinarily, compression plants will be located after the holder and will have to be large enough to care for the peaks in the send-out. This will usually mean that the compression plant will be twice as large as if it could be located before the holder. No account has been taken of this in fixing the capital cost of the compressor plant nor has allowance been made for a spare or standby compressor. The compressor plant, the cost of which is used, would be large enough to handle 5,000,000 cu.ft. per day operating 24 hr. per day.

Present Distribution at 15 Pounds

The additional daily costs of operation for compression to 33½ lb. would be as follows:

	Coal Gas	*Water Gas*
Labor		
No additional charges		
Steam		
The compressors will be driven by steam condensing at 26-in. vacuum, 16 lb. of steam per hp.-hr., 48,000 lb. per day at 50 cents per 1,000 lb.	$24.00	$24.00
Water		
200,000 gal. at 2 cents per 1,000 gal.	4.00	4.00
Maintenance, Repairs and Supplies	1.00	1.00
Condensation Loss	2.48	5.15
Fixed Charges		
13 per cent of $40,000	14.25	14.25
Total cost per day	$45.73	$48.40
Cost per M. cu.ft. of gas	$ 0.0091	$ 0.0097

These costs are for winter operation. During the summer the load on the 15-lb. plant would be less because it is only necessary to compress to 21½ lb. gage to lower the dew point to 55 deg. F. as previously indicated. Under summer operating conditions the additional daily cost of operation for this plant would be reduced from the previous figures and would be as follows:

	Coal Gas	*Water Gas*
Labor		
No additional charges		
Steam		
23,000 lb. per day at 50 cents per 1,000 lb.	$11.50	$11.50
Water		
80,000 gal. at 2 cents per 1,000 gal.	1.60	1.60
Maintenance, Repairs and Supplies	1.00	1.00
Condensation Loss.	0.81	1.55
Fixed Charges		
13 per cent per yr. of $40,000	14.25	14.25
Total cost per day	$29.16	$29.90
Cost per M. cu.ft. gas	$ 0.0058	$ 0.0060

Therefore, averaging the costs for summer and winter conditions, it may be stated that the additional expense chargeable to dehydration by compression of a gas already being distributed at 15 lb. pressure will be about $0.008 per M. cu.ft.

Applications of Stainless Iron in the Nitric Acid Industry

By Walter M. Mitchell

Central Alloy Steel Corporation, Massillon, Ohio

THE old saying that "necessity is the mother of invention," was never better illustrated than by the development of the stainless irons which has taken place in the last few years. Previous to 1925, production of these high chromium alloys was in lots of a few tons only, but with the realization by chemical industries of their tremendous potential importance as a material for the construction of equipment for the manufacture and handling of nitric acid, production has increased to hundreds of tons and the alloys have assumed prominence exceeding the fondest expectations of the metallurgical optimist.

In chemical industries, the selection of materials for the construction of apparatus for the manufacture of products which are by nature corrosive is one of the most important problems to be solved. No process can be considered complete or commercial until materials have been secured for the equipment necessary for its large-scale operation. In the past the importance of this was overlooked, perhaps because many of the processes were simple and a fairly satisfactory material was easily found; or corrosion was accepted as inevitable, and the matter rested at that. But with the advent of the newer synthetic processes, the problem has become much more important. When we realize that for the synthesis of ammonia according to the Claude process containers must be secured which will withstand pressures of 15,000 lb. per sq.in. at 1,000 deg. F., and at the same time be immune to the action of hot hydrogen, the difficulties encountered may be appreciated.

The production of nitric acid by the oxidation of ammonia is a somewhat simpler type of process, and it is fortunate that metals, the high chromium-iron alloys, which satisfactorily resist this acid, are already available.

IT IS well known that nitric acid attacks most metals even at ordinary temperatures, exceptions being the noble metals such as gold, platinum, iridium, etc., which are too costly for use, and the more common metals aluminum and chromium. Previous to the introduction of chromium alloys, the only commercial materials in which nitric acid could be handled were stoneware and vitreous materials, the high silicon irons (13 to 15 per cent silicon), and aluminum. Iron, which is fairly resistant to highly concentrated acid, is rapidly attacked by dilute acid and hence is not usable.

Aluminum is generally satisfactory for cold, dilute or concentrated acid, but is not serviceable when the concentration of the acid is around 20 to 30 per cent; while with increase in temperature, the rate of attack for all concentrations is increased. But the recognition that the iron-chromium alloys of the stainless analysis were highly resistant to nitric acid has brought about a complete change in the situation. These alloys, made with low carbon, may be produced in virtually all necessary forms, have ample strength and toughness, can be fabricated without undue difficulty, and are not prohibitive in cost compared with vitreous materials.

WHILE stainless alloys are not resistant to crude nitric acid produced by the older process from Chile saltpeter because of the high content of chlorides, bromides and iodides, all of which attack chromium, the purified acid is satisfactorily resisted, as is acid produced by the oxidation of ammonia, which is free from such impurities. Hence, the interest of the chemical industry in these alloys.

The largest tonnage of stainless iron will be consumed in the construction of the acid manufacturing plants themselves, but in addition to such installations, equipment for transportation of acid will be required. This includes tank cars, and shipping drums of various sizes. Tank cars are already being constructed, and drums of various compositions have been experimented with for some years.

While the stainless irons are distinctly stronger and tougher than low-carbon steels used for structural purposes, and hence have ample strength for any ordinary equipment, they have individual peculiarities which necessitate special provisions in any set of specifications to prevent the entrance of material which would prove unsatisfactory in service. Specifications should therefore provide:

1. A metal which will have ample corrosion resistance for the purpose. In this case, corrosion resistance is purely a matter of the composition and quality of the metal. Therefore, proper composition must be specified, with whatever tests are necessary to demonstrate its freedom from slag inclusions, excessive grain size, etc.

2. A metal which will have the necessary strength and ductility for purposes of fabrication. Ductility is highly important. Unfortunately, the stainless alloys of the high chromium range have inherent propensities for becoming brittle if improperly handled in mill operations. Hence, ample bend and other ductility tests must be included to prevent brittle material being furnished. Greater weight should be given to such tests than to tensile tests made merely for strength.

Specifications covering stainless irons have been prepared by E. I. duPont de Nemours and Company, The Atmospheric Nitrogen Corporation, Chemical Construction Company and others. For obvious reasons, no at-

Extracts from a paper presented before the American Society for Steel Treating, Philadelphia, Oct. 8 to 12, 1928.

tempt will be made to identify the various details of the specifications discussed in what follows with any of these companies.

The chromium content is the all-important factor which determines resistance to nitric acid. An alloy with 14 per cent chromium will resist concentrated acid, but not the very dilute acid. A chromium content of 16 per cent, however, will resist any concentration of cold acid, and is only very slightly attacked by hot acid. In consequence, a minimum of 16 per cent chromium has been generally specified by all companies, with the exception of one, who consider 17 per cent the proper minimum. The maximum is limited at 19 to 20 per cent. The higher cost of the higher chromium alloys, and their more difficult workability set a natural upper limit.

Carbon is to be maintained low, always under 0.12 per cent, except for castings, which will be discussed later. Low carbon is desirable, to avoid air hardening tendency and brittleness in case the metal should inadvertently be heated to a too high temperature. The lower the carbon, and it may easily be held to 0.10 per cent maximum, the greater the ductility of the metal.

> The unique and spectacular development of the stainless irons has solved the problem of locating cheap material for the construction of equipment for the manufacture, storage and shipment of nitric acid.

The silicon content has led to considerable discussion because of the higher percentage in alloys produced under Armstrong patents. Those who have listened to the emissaries of the holders of the Haynes and Brearley patents have restricted silicon to 0.50 per cent maximum. According to Monypenny (Stainless Iron & Steel, page 164), silicon is desirable because it appears to increase resistance to mineral acids to a slight extent at least, and to reduce air hardening tendencies. There is no question but that a small addition of silicon is a distinct advantage, particularly to the steel maker, both in the melting process, and in mill and fabricating operations, where it facilitates hot working. Excessive silicon, however, is quite undesirable since it encourages grain growth and lowers resistance to shock. It is difficult to set an exact limit, but a safe limit appears to be about 1.0 per cent maximum for bar stock for rivets, bolts, nuts, etc., and 1.10 per cent for plates, tubing, etc.

The percentage of manganese is important from the standpoint of corrosion resistance, and this element should be held low, 0.35 to 0.40 per cent being a satisfactory limit, and in no case should 0.50 per cent be exceeded.

PHOSPHORUS and sulphur may be maintained low, and are usually specified at 0.025 per cent to 0.030 per cent maximum. From the scanty information available they appear to affect corrosion resistance adversely.

The nickel content is important. The first effect of added nickel on physical properties of stainless alloys is lowering of the critical range and increased tendency toward air hardening. With nickel above about 2 per cent, stainless steels gradually become martensitic and are commercially unimportant. With nickel over about 7 per cent and chromium 16 per cent the alloy becomes austenitic with properties characteristic of alloys of this type. It was originally supposed that nickel reduced resistance to nitric acid, even if present in small quantities. Specifications accordingly restricted nickel to 0.40 per cent and in some cases to as low as 0.25 per cent. This latter figure was not always easy to maintain because of the contamination of practically all scrap with at least a small proportion of nickel.

Fears regarding corrosion resistance seem to be ill founded because nickel in reasonable proportions does not appear injurious, although evidence for this is not altogether complete. Certain strengths of acid, particularly "C.P." acid have a slight tendency to attack, but the commercial or strong acids seem to be free from effect.

Interest in austenitic chromium-nickel alloys lies in their better welding qualities compared to straight chromium iron. For this reason chromium-nickel alloys of the "18 and 8" analysis are preferred for acid shipping drums which must be constructed by welding. Also because of the greater ductility of alloys of this type and their somewhat "fool proof" characteristics.

Copper is not ordinarily a constituent of stainless alloys. Its presence, because of its readily oxidizable nature would seem objectionable on theoretical grounds. Specifications usually restrict copper to 0.2 per cent or less where it is considered merely as an impurity.

Plates are used for construction of absorption towers, tank cars, large size piping, and various other parts of equipment. Two main processes for the oxidation of ammonia have been developed. In one, operations are carried on under high pressure (100 lb. per sq.in.). In the other, under nominal or low pressure. In the latter process the absorption towers are constructed as large as can conveniently be farbricated. On account of the careful procedure required in riveting, field construction of towers has not been attempted. This necessitates construction in the shop, and shipment assembled to the plant site for erection, which restrict diameters to about 10 ft. and height to 50 to 60 ft.

FOR THE 10-ft. towers $\frac{1}{4}$-in. plate is used, except for the lower courses which are made from $\frac{3}{8}$-in. plate. As pressure is nominal no particular strength is required beyond that the structure will not be in danger of collapsing. In the high pressure system, and this is its great advantage, one smaller tower replaces a number of large ones. This tower is usually made of $\frac{3}{8}$-in. plate. For such plates it is obviously essential that all tensile tests be passed satisfactorily.

Plate specifications require the following minimum physical properties:

Tensile Strength	70,000 lb. per sq.in.
Yield Point	45,000 lb. per sq.in.
Elongation in 2 In.	25 per cent

One-piece dished and flanged heads are used for the ends of the absorption towers. No particular difficulty has been experienced in producing these up to 10 ft. in diameter. But as the plate in the finished heads cannot be tested without destroying the head comparative hardness tests are provided, the basis for acceptance being agreement of Brinell or scleroscope readings within 10 per cent of those obtained on plate material known to be satisfactory. Heads should be annealed after the final spinning operation and all scale removed as with plates.

Rivets are probably the most important of the stainless products used in construction, for the success of the finally fabricated structure depends upon their holding together and staying in place. Riveting with stainless rivets nearly wrecked the whole development at the outset because of the facility with which chromium alloys air harden if improperly handled. Workmen accustomed to heating steel rivets to 1,900 or 2,000 deg. F., did the same with stainless rivets only to see the heads snap off when cold or at the slightest blow of the hammer. Fortunately means have been found to prevent such casualties, and it is now possible to drive stainless rivets which are apparently as strong as steel rivets of similar dimensions.

AT THE time of preparation of the first specifications there was much concern lest there be recurrence of the casualties above reported on some inconvenient occasion after operation of the plant had begun. This together with considerable uncertainty as to just what could be expected of this metal, led to the inclusion of rather elaborate tests for both the bar stock from which rivets were to be made, and for the finished rivets. Minimum strength requirements for rivet stock were as follows:

Tensile Strength	60,000 lb. per sq.in.
Yield Point	40,000 lb. per sq.in.
Elongation in 2 In.	25 per cent
Reduction in Area	50 per cent

Two companies have since raised the tensile strength and yield point to 70,000 and 45,000 lb. per sq.in. respectively. There can be no objection to this, and these figures may well be adopted as standard, since they are within the possibilities of the material.

The production of seamless drawn tubing presented many difficulties at the start and much "grief" was experienced before production in commercial quantities was an accomplished fact. Difficulties were encountered in both the piercing and the drawing operations, but these have now been successfully overcome, and drawn tubing in a range of sizes up to 5 or 6 in. outside diameter, in practically all stainless iron analyses, can readily be obtained. Larger sized seamless tubing is now being produced by forging a pierced billet on a mandrel to the proper length and diameter, also by turning up the outside of a large forged cylindrical billet and removing the core by a trephining operation. Truly an expensive procedure in either case.

IN PLANT construction tubing is used for pipe lines, heat exchangers, condensers, etc. It must therefore possess certain definite qualities; namely, sufficient ductility to be bent and flanged without splitting, freedom from seams and porosity so as to be gas tight, accurate uniformity in size to permit the attachment of fittings, etc., without extra machine shop work.

As tubing is produced in virtually all low-carbon analyses the question of special compositions may be disregarded and the same analysis demanded as for plates and rivets. For heat exchangers, which are subjected to higher temperatures a more heat resisting material may be required. The austenitic chromium-nickel alloys of the "18 and 8" composition may be used for this purpose.

Castings are used for flanges, nozzles, valves, pump casings, pipe fittings such as ells, tees, etc., and parts of equipment not conveniently fabricated by any other means. As castings will be in contact with the gases and liquids generated in the process they should have as closely as possible the same chemical composition as that of plates, tubing, etc. Unfortunately, the low carbon of the stainless irons does not lend itself to foundry purposes, for castings of that composition are much addicted to blow holes and porosities. If carbon is raised to 0.30 or 0.35 per cent maximum, a much better foundry metal results. Other elements should be kept as close to the plate and tube analysis as possible, but a slight increase in impurities will probably do no harm. With carbon up to the content mentioned resistance to nitric acid does not seem to be effected. The straight chromium alloys show an extremely coarse grain when cast and are also entirely too hard for machining. A proper annealing treatment will produce reasonable machinability and surprisingly good physical properties although very little grain refinement takes place.

Only one chemical company requires a tensile test on cast material, the following physical properties being required:

Tensile Strength	75,000 lb. per sq.in.
Yield Point	50,000 lb. per sq.in.
Elongation in 2 In.	10 per cent
Reduction of Area	15 per cent

These are well within the limits of the material. Impact strength values are inclined to be uncertain, and are to be reported "as information."

FORGINGS are used for flanges, pipe fittings, pump shafts and plungers, and other parts of equipment where a better metal than that obtained in castings is desired. Specifications for composition should remain the same as for plates, tubing, rivets, etc., since this analysis may be forged without great difficulty. Important defects to be guarded against are coarse grain structure resulting from too high finishing temperature, insufficient annealing leaving the metal unmachinable, and the usual forging defects such as seams, laps, cracks, etc.

Tentative specifications for stainless iron plates, tubing, castings, etc., for the construction of tank cars for shipment of nitric acid in bulk have been drawn up by the Mechanical Division of the American Railway Association. These follow the duPont specifications and embody the important points discussed in this paper. Fabrication of tank cars should present no greater difficulty than absorption towers or stationary tanks, but because of the rough handling and vibration to which tank cars are subjected in service the greatest precautions must be observed to insure proper strength in the metal, with tightness and stability of riveted points. This is particularly important for the shipment of nitric acid. While leakage would be undesirable in any case, there is danger, other than financial loss, for nitric acid, especially strong acid, is a most powerful oxidizing agent and if brought into contact with organic matter will almost invariably start a fire.

CHEMICAL compositions for plates, tubing, castings and other parts will naturally be the same as already discussed.

It has been customary to ship nitric acid in glass carboys which, because of their fragile nature and the danger or fire from contact of nitric acid and organic matter, cannot be considered ideal containers. Consequently stainless irons have been welcomed by chemical industries as a means of solving this phase of the nitric acid problems as well as that of manufacture.

Varied Factors Control Favorable Choice of Cracking Process

By Ernest Owen
Boston, Mass.

REFINERY executives when confronted with the problem of determining what cracking process shall be installed in their refineries should analyze the data submitted from a mechanical and economic standpoint. In evaluating the merits of the various processes, the following factors should play an important part in arriving at a final decision:

(1) Yields of gasoline.

(2) Quality of products. The cost of rerunning if necessary, and treating the gasoline produced should be given due consideration, together with its anti-knock properties. The viscosity and presence of colloidal carbon and sludge will have an important bearing on the marketability of the fuel oil obtained.

(3) Capital investment per barrel of gasoline produced per day.

(4) Fuel consumption. This will depend on the furnace efficiency, the provision made for heat interchange and conditions under which cracking takes place.

(5) Production of fixed gas and coke.

(6) Flexibility of operation. The flexibility of the process should be considered in the light of its ability to handle various types of charging stocks, as topped crude, fuel oil, gas oil and kerosene, to suit changing market conditions, and also the possibility of varying the end-point of the gasoline produced from the unit.

(7) Safety of operation.

(8) Ease and simplicity of control, insuring uniformity of production and uniform yields over long periods.

(9) Service factor, or percentage of time the unit is on stream.

(10) Operating costs. This item is dependent on some of the factors mentioned above and also on other items, as rate of depreciation and cost of repairs and replacements.

(11) License charges and patent protection.

As a guide to his judgment it is suggested that the refinery executive prepare a realization statement, providing of course that he has access to the records of other plants in which the cracking processes under consideration are installed, showing the returns that may be expected from the several competitive processes. A form that may be used for this purpose is given in Table I.

One of the hardest factors to estimate satisfactorily is obsolescence or "functional" depreciation. While future engineering and economic developments in the cracking industry may not be so revolutionary as during the past few years, there is no assurance that this will be the case and there are always possibilities of further radical changes and developments.

Table I—Realization Statement for Guiding Choice of Process

Value of Finished Products

Gasoline	Gas (fuel oil equivalent)
Fuel Oil	Gas Oil (if produced)

Cost of Finished Products

(a) Fixed Charges	(b) Operating Charges
(1) Interest on Investment	(1) Raw Materia'
(2) Taxes and Insurance	(2) Maintenance and Repairs
(3) Physical Depreciation and Obsolescence	(3) Labor and Direct Supervision
(4) General Plant Overhead (administration, office, laboratory, etc.)	(4) Steam, Air, Power, Light and Supplies
(5) Royalty	(5) Fuel and Water
	(6) Rerunning and Treating Operations

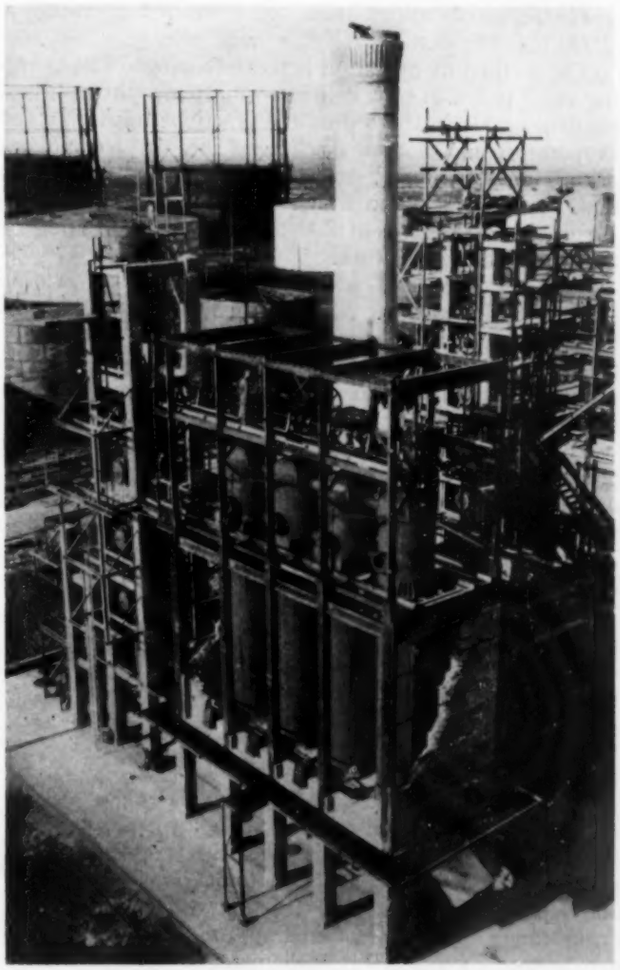


Fig. 1—Holmes-Manley Unit of the Texas Company Under Construction

SOME leading processes to be taken into consideration by the refinery executive have already been discussed by the author in previous issues of *Chem. & Met.* Treatment of vapor-phase installations (October, page 610) and discussion of the Burton, Dubbs, Isom, and Jenkins processes (November, pages 677-681) are now joined by a consideration of the major remaining systems. These are the Cross, Holmes-Manley and Tank and Tube processes, which are treated in order below.

Cross Cracking Process: A diagrammatic layout of the latest type of the Cross unit is shown in Fig. 3. This process is licensed by the Gasoline Products Corporation, and was erected by the M. W. Kellogg Company of New York. Essentially the Cross cracking process consists in heating the oil to a cracking temperature, holding the heated oil substantially in a liquid form long enough for the cracking reaction to take place, then releasing the pressure and allowing the hot oil to distill under careful control so that the resulting products are gasoline, gas oil and fuel oil. It should be noted that in this process substantially no vaporization is allowed to take place in the cracking zone, with the result that there is little drop in temperature (except from the endothermic reaction of cracking) in the oil until the completion of the cracking reaction in the soaking drum. This insures a high rate of conversion.

The size of the units has been more or less standardized, the usual ratings being 1,000, 2,000, and 2,600 bbl. per day of fresh charge. In the description which follows, the specifications given are for a unit operating at 2,000 bbl. per day.

The method of operation is the following. The charging stock is fed in by a cold charging pump through heat exchange coils in the top of the fractionating tower and evaporator, and is then discharged into an accumulator or mixing tank. Suction is taken on the accumulator tank by a hot oil pump which discharges to the cracking furnace at a pressure of 700 to 1,000 lb., depending on the type of charging stock.

In the cracking coil, which has 5,200 sq.ft. of heating surface in the form of 3¾-in. I.D., 5-in. O.D. tubes, the oil is heated to a temperature varying from 850 deg. F. to 910 deg. F. In the latest design of the Cross units provision is made for flue gas recirculation and the installation of an air preheater.

The oil after having been brought rapidly to a cracking temperature is then conducted to an unheated but thoroughly insulated "reaction chamber." This chamber, which is forged out of a solid ingot and bored to an internal diameter of 52 in., has an overall length of 45 ft. and a minimum wall thickness of 4 in.

The synthetic crude after being held in the reaction chamber for a period of about twenty minutes, is allowed to escape through a piston slide valve at which point substantially all the pressure is released. The synthetic crude discharges into a vaporizer or evaporator tower 8 ft. in diameter by 48 ft. high, where the cracked mixture separates into a residual fuel oil, which is continuously drawn off at the bottom, and vapors which pass into a fractionating tower. This fractionating or dephlegmator tower is 9 ft. in diameter by 74 ft. high and contains fifteen bubble trays with triangular caps. In this tower the entire gasoline content is quantitatively separated, while a gas oil is withdrawn hot from the bottom and run continuously into an accumulator tank, and from there again passes to the furnace. It is claimed that through automatic temperature control, any endpoint gasoline desired can be taken overhead from the dephlegmator tower and any quality of fuel oil can be withdrawn from the bottom of the evaporator.

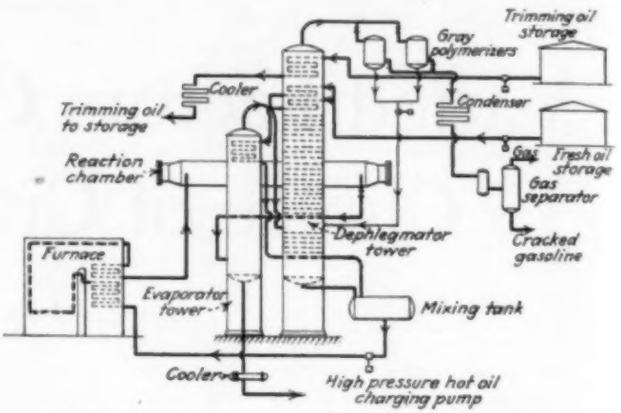


Fig. 3—Newest Type of Cross Cracking Installation

If a high gravity fuel oil is required, it is usual to put steam in the bottom of the evaporator tower to reduce the flashpoint of the fuel oil. Because of the high pressure carried in the reaction chamber the oil is substantially in a quiescent state, allowing the carbon formed to settle out and resulting in a fuel oil practically free from carbon.

Below are summarized the essential operating data relating to the process. It is claimed that these results are obtained from the latest units, the gasoline yields being much higher than in the old type units in which there was no internal recycling.

Coke production—⅛ lb. per bbl. of fresh stock charged when cracking kerosene to 2½ lb. per bbl. of fresh stock in the case of Smackover topped crude.

Fuel consumption—5 to 7 per cent of fresh charge, if the fixed gas produced is not used.

Yields of Gasoline—437 deg. F. endpoint	
Kerosene	78 per cent
Gas oil	67 per cent
Fuel oil	55 per cent
Percentage of time on stream	
Kerosene	93 per cent
Gas oil	90 per cent
Fuel oil	85 per cent

Gray towers filled with fullers earth may be installed in connection with the cracking unit for treatment of

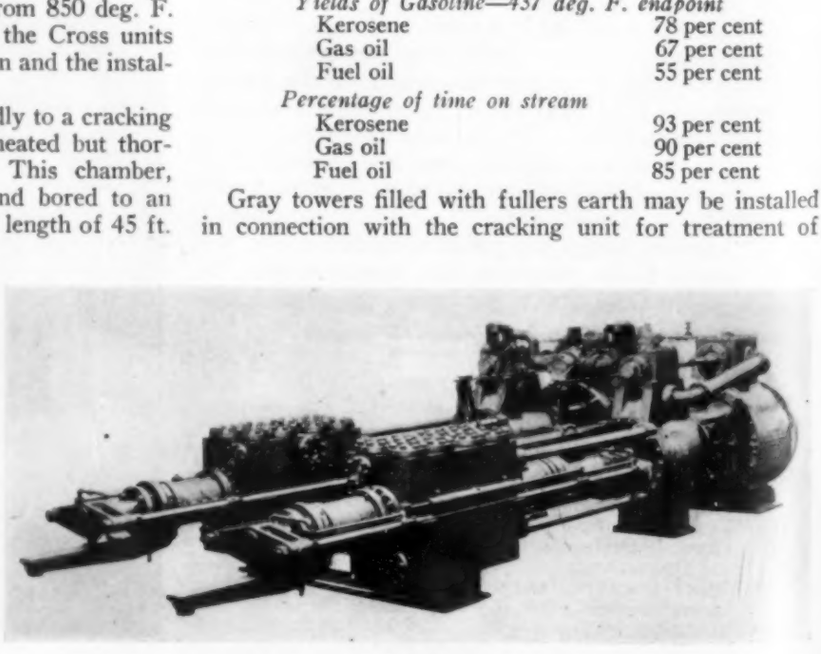


Fig. 2—Hot Oil Plunger Pump of Forged Steel for 1500 Lb. Pressure and 900 Deg. F.

the gasoline vapors, in which case a 30 plus color stable gasoline is produced direct from the unit that requires only a doctor, or caustic and water wash to insure a stable, doctor sweet, negative corrosion gasoline.

Holmes-Manley Process: The first commercial units of the Holmes-Manley process were built by the Texas Company at its Port Arthur (Texas) refinery in 1919, following a number of years of experimental work. Today the Texas Company has over one hundred units in operation at its own plants and fifty odd units at other refineries throughout the country. The method of operation is indicated quite clearly in Fig. 4. The data which follow are based on one of the latest units having a through-put capacity of 2,000 bbl. per day, and designed to stand a pressure of 600 lb. per sq.in. Actually these units operate at a pressure in the neighborhood of 400 lb. It will be noted that this pressure is considerably higher than that carried on the older units which were designed for 250 lb.

The principal items of equipment entering into the construction of one of these units are as follows:

(1) Cracking coil, comprising an economizer and preheater section, containing a total of 5,200 sq.ft. of heating surface.

(2) Four vertical "stills" or soaking chambers, 5 ft. I. D. by 41 ft. long. The shells, which are electrically welded, are 3 in. thick. These stills are enclosed in a brick setting and are heated by three sets of gas burners for about two-thirds their lengths. The products of combustion are discharged into the cracking coil setting just below the economizer section. A system of scrapers are installed in each still for the purpose of removing the carbon from the walls and agitating the oil. A liquid equalizer line is provided about ten feet from the top of the stills and a vapor equalizer line a few feet below the top.

(3) Fractionating column containing 18 bubble trays 6 ft. I. D. by 43 ft. long. Shell 2⅜ in. thick.

(4) Reflux exchanger 4 ft. 6 in. I. D. by 14 ft. long, containing twelve 1¼-in. spiral pipe coils.

(5) Two spiral coil heat exchangers.

(6) Auto-tar stripper comprising (a) Flash tower 5 ft. x 32 ft.; (b) two bubble fractionating towers 5 ft. x 32 ft.; (c) water cooled exchanger and condenser.

The method of operation is outlined in the following: The charging oil after being preheated in its passage through the reflux exchanger, is pumped through the economizer and then through the preheater sections of the cracking coil, where it is brought to a cracking temperature. It then flows through the four vertical stills in series, the oil being held in these soaking chambers for a period of about six hours. Lower operating temperatures are carried in the cracking zone than in some of the competitive processes, as the Cross.

The tar which is formed and contains most of the coke in suspension, is withdrawn continuously from the bottom of the soaking drums and delivered to an auto-tar stripper unit under much reduced pressure. In this unit, utilizing the heat contained in the tar, a fractionation into naphtha, gas oil and fuel oil is effected, with the aid of superheated steam, which is injected into all three towers.

The vapors from the vertical "stills" pass overhead into a bubble tower and reflux condenser, where the separation into recycle gas oil and gasoline is obtained. The recycle gas oil is returned to the cracking coil, while the gasoline vapors flow to water cooled condensers. The gasoline condensate is then delivered to a receiver drum where the pressure is relieved; fractionation and condensation are effected under full operating pressure.

A typical yield statement when running 2,000 bbl. of gas oil per day is shown below:

			Per Cent
Charge	Virgin gas oil	1,300 barrels per day	65.0
	Cycle gas oil	700 barrels per day	35.0
	Total	2,000	100.0

Yields from Pressure Stilling

	Bbls	Per Cent
Gasoline	780	39.0
Pressure bottoms	1,120	56.0
Loss, gas and coke	100	5.0
Total	2,000	100.0

Yields from Stripping Pressure Bottoms

	Lb.	Per Cent
Gasoline	67	6.0
Cycle gas oil	700	62.5
Cycle fuel oil	353	31.5
Total	1,120	100.0

Final Yields of Products

	Based on Total Charge		Based on Fresh Charge	
	Bbl.	Per Cent	Bbl.	Per Cent
Gasoline	847	42.4	847	65.0
Cycle gas oil	700	35.0	....	.....
Fuel oil	353	17.6	353	27.3
Coke, gas and loss	100	5.0	100	7.7
Total	2,000	100.0	1,300	100.0

The Holmes-Manley units operate on long cycles, record runs considerably over six months long having been recorded in a number of instances.

Tank and Tube Process: The Tank and Tube process was developed by the Standard Oil Company of New Jersey. Originally designed as a moderate pressure unit the pressure in the soaking drums has been increased to 350 lb., then to 450 lb. and in the later units to 750 lb. per sq.in. Now it is reported that new units are being designed for 1,200 lb.

While certain basic ideas have been adhered to in the layout and general design of all the units, nevertheless the detail design of the various parts of the units has been more or less modified by the technical staffs of the different refineries in which the process has been installed. Fig. 5 shows a diagrammatic layout of one of the latest 750-lb. units, having a charging capacity of approximately

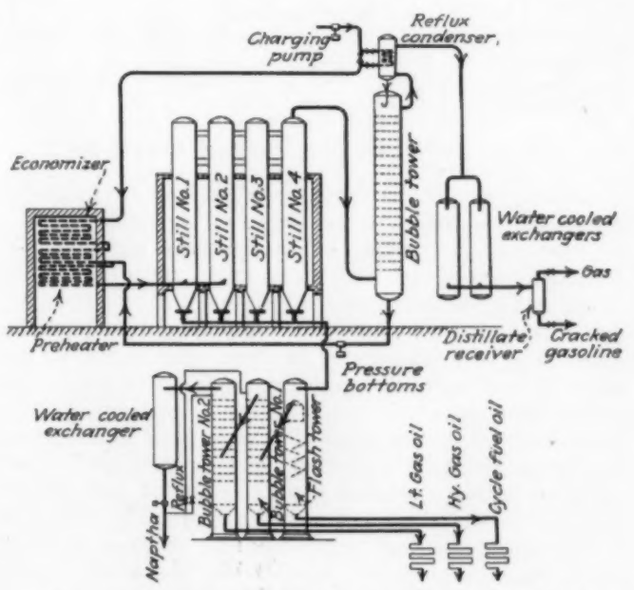


Fig. 4—Diagrammatic Layout of Holmes-Manley Unit

2,500 bbl. per day. The apparatus comprising this unit is as follows:

(1) Cracking furnace containing 165 4½-in. O.D. cracking tubes and two reboiler coils.
(2) 6-ft. I.D. by 40 ft. long forged steel soaking drums, having a minimum wall thickness of 5½ in. There are three drums for each two units.
(3) Two separators in 8 ft. diameter by 30 ft. long.
(4) Three shell and tube interchangers.
(5) One accumulator, 8 ft. in diameter by 30 ft. long.
(6) Four shell and tube partial condensers.
(7) Bubble towers (a) One primary tower 10 ft. x 40 ft. containing 11 plates. (b) Secondary tower 9 ft. x 40 ft. containing 11 plates.
(8) Distillate, refractory gas oil and tar coolers.

The method of operation may be outlined as follows: The charging stock is pumped through the four partial condensers where it is preheated to 450 deg. F. and then flows into an accumulator. A hot oil pump picks the oil up from the bottom of the accumulator and discharges it through the three heat interchangers into the cracking coil at a temperature of 600 deg. F. The oil after being heated to about 875 deg. F. flows into the soaking drum or reaction chamber where the cracking proper takes place, the soakers being "swung" or alternated as the coke builds up to a predetermined level. The pressure is released at the outlet from the soakers to about 40 lb., and the oil and vapors are flashed into a separator. The liquid residuum or tar is drawn off continuously through a cooler from the bottom of the primary separator, while the vapors pass overhead into a secondary separator and thence through three interchangers to a primary bubble tower for fractionation. The gas oil bottoms from this tower, after having been subjected to a reboiling action, flows into the accumulator for retreatment. The overhead from the tower passes through three partial condensers to a secondary bubble tower for separation into a refractory gas oil bottom, which is removed from the system, and on overhead distillate, containing the gasoline fraction.

The latest operating data on this process when running gas oil is given below:

Amount of oil (fresh plus recycle) circulated through the cracking coil per hour = 13,000 gal.
Fresh feed charged to the unit per hour = 5,700 gal.
Amount of gasoline produced per hour = 3,000 gal.
Coke per barrel of gasoline = 3 lb.
Gas produced by unit more than equals the fuel requirements.
Fuel oil may also be used as a charging stock, yielding approximately 30 per-cent gasoline.

Characteristics of Cracked Gasoline

During the past five years there has been a remarkable transition of opinion among the motoring public regarding the relative values of straight-run gasoline and "cracked" gasoline. For many years refiners without cracking facilities emphasized the superiority of straight-run gasoline as a motor fuel. And they were partially justified in maintaining this position, since in the earlier days of cracking much synthetic gasoline was put on the market that had a bad odor, color, and gumforming characteristics. With the gradual improvement in manufacturing and treating technic refiners have succeeded not only in making a cracked gasoline equal to straight-run but have produced a superior motor fuel. The discovery that "cracked gasoline," especially that obtained in vapor phase cracking, possesses considerable "anti-knock" properties has placed it in a premium class.

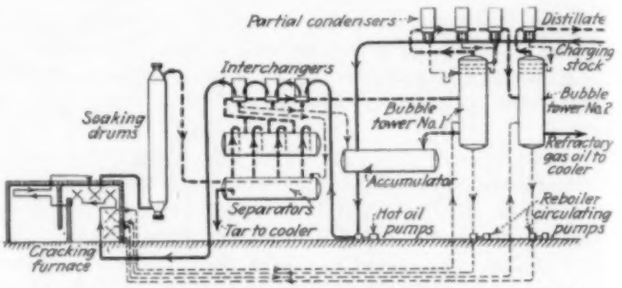


Fig. 5—Tank and Tube 750-Lb. Unit With Capacity of 2500 Bbl. per Day

The anti-knock or non-detonating properties of motor fuel depend on the percentages of paraffine, unsaturates, naphthenes and aromatic hydrocarbons present. Of these four groups, the aromatics are the best non-detonators, naphthenes and unsaturated hydrocarbons next in order of value, and the paraffines the poorest. The knocking propensities of motor fuel may also be greatly modified by the addition of certain chemicals, as tetra-ethyl lead, iron carbonyl, colloidal sols of iron, and the aromatic amines such as aniline and para-toluidine and the iodine compounds. The use of tetra-ethyl was developed by the General Motors Research Corporation, and is now marketed by the Ethyl Gasoline Corporation, the stock of this company being owned jointly by the General Motors Corporation and the Standard Oil of New Jersey. Many of the "dopes" which have been advertised in the past, have however no special value so far as the anti-knock properties of motor fuels is concerned. Indeed some, like nitro-benzene, actually induce knocking in motors. In a recent talk Dr. Egloff spoke of a collection of 300 samples, sold on the open market, practically all of which were found worthless and most of which were nothing but moth balls, variously colored.

As the compression ratios of automobile engines is increased, the non-detonating features of cracked gasoline become of more and more importance. The refining industry is at the present time endeavoring to develop this anti-detonation property of synthetic gasoline to such a high degree that in the future manufacturers can put out a much more efficient engine which will result in doubling the number of miles that the motoring public will be able to get from a gallon of gasoline. If this can be accomplished its importance on future consumption of gasoline can be readily appreciated as nearly fifty millions of cars and trucks could be operated on the amount of gasoline that is now being consumed.

It is interesting to note one development in connection with the sale of cracked gasoline, and that is the tendency to color them red, pink, purple, blue and green, in fact nearly all the colors of the rainbow.

Finally, it may be commented that if the cracking industry continues to evidence the spirit of progress that it has shown in the past—adapting itself to changing economic conditions, devising and developing new ideas, and constantly endeavoring to do things in a better way—then we may expect it to maintain its position of economic importance in the production of motor fuels, regardless whether our future supplies be derived from petroleum, shale, or coal.

Editor's Note: With the present article, Mr. Owen concludes the series of three that he prepared for Chem. & Met., the previous papers having appeared in the October and November issues. In the latter were discussed the development of cracking, vapor-phase cracking and several of the major liquid-phases processes, which at present play the dominant rôle in this important source of gasoline.

Hydrogen from Coke Oven Gas Gives Cheap Ammonia at Ostend

By F. A. F. Pallemaerts

Manager of Research, Division of Coke Ovens and Synthetic Ammonia, Union Chimique Belge, Brussels, Belgium

AT OSTEND is located the first of a series of synthetic ammonia plants to be built by the Union Chimique Belge and the first plant to combine the Linde system of coke oven gas fractionation with the Casale synthetic ammonia process. The success of the Ostend plant was the signal for a rapid increase in the number of similar plants combining the Linde system of hydrogen manufacture from coke oven gas with one of the now classic synthetic ammonia processes. At the present time about a dozen plants of this type are in operation and several others are being planned.

Up to the present, the capacity of plants of this type does not exceed a production of 72 tons of ammonia per day, for the reason that gas is not available in sufficient quantities from existing coke oven plants to give larger outputs, and due to the fact that distillation works have not yet been systematically concentrated in Europe. A movement is now afoot, in this direction in Belgium, where a series of Central Carbonization plants is being planned, arranged for generation of power and utilization of gaseous byproducts. The first of these Central Coking plants is to be erected in the Southern Belgium coal field (Borinage) and will comprise a synthetic ammonia plant of the U.C.B.-Casale-Linde system, the first section of which will have a capacity of 72 tons of ammonia per day. A second central plant in Hainaut will probably be completed then.

The original Ostend plant, which was really experimental as it constituted the first application of the combined U.C.B.-Casale-Linde system, was built for an output of 12 tons of ammonia per day. It comprised three 6-ton Casale units and three corresponding Linde units, one unit of each plant being in reserve.

Since then four additional Casale units have been installed and the hydrogen plant has been increased by two large units, each of 3,000 cubic meters capacity of hydrogen-nitrogen gas; with these the plant produces 40 to 55 tons of ammonia per day.

A special process had to be developed to purify the coke oven gas in view of its use for liquefaction, and it was found necessary to make slight alterations in the liquefaction process itself during the early stages of the starting up of the plant. Considerable success was secured after these changes were effected, and the plant is producing ammonia regularly at low cost.

When the manufacture of synthetic ammonia was decided upon by the Semet-Solvay & Piette Company (which has since become a division of the Union Chimique Belge), the first problem was the choice of a cheap source of hydrogen. Coke oven gas was chosen for, at least under European conditions, electrolytic hydrogen is either too dear or not available in large quantities in most European countries. The next question was how to obtain hydrogen from this source. Several processes were investigated, including fractionation and the iron-steam processes. The latter were eliminated as insufficiently proved or requiring units that were too small and giving impure gas. Of the fractionation processes, two were taken under consideration. These were the Claude and Linde systems.

It is not often that a paper presented before a technical conference creates so great a stir among those hearers who are directly concerned, nor as much interest among technical men in general, as the discussion which Mr. Pallemaerts of the Belgian Chemical Union presented at the Bituminous Coal Conference. In it he freely disclosed costs and many other details of his company's synthetic ammonia plant at Ostend. The paper, slightly condensed, appears here.

In principle, the Claude system applies expansion with external work, by releasing the compressed gaseous mixture in an expansion engine, while the Linde process utilizes the well-known Joule-Thomson effect of self-intensive cooling through expansion without external work. For several reasons, the Linde system was preferred. For one thing, the Claude hydrogen process produces a less pure gas which has to be treated in the synthetic process by one or two precatalyses.

After completion of the plant, for the first few weeks of operation the production was low and irregular, and improvements bearing almost entirely on the purification of the coke oven gas, preliminary to its fractionation, had to be made. Thereafter the production rose steadily, until it reached an average of 18 tons, with peaks of 23 tons, giving a regular output 50 per cent above that for which the plant was intended.

A small amount of preliminary work had been done at Oberhausen in the Ruhr district. All that was known from the Oberhausen experience was that the gas had to be dry and should not contain any carbon dioxide; also that it probably would have to be desulphurized before compression. These operations had been effected through purification of the gas in iron oxide purifiers, followed by compression, washing under pressure with water to remove CO_2, a final decarbonatation by means of caustic

Taken from the author's paper presented on Nov. 20 at the Second International Conference on Bituminous Coal at Carnegie Institute of Technology in Pittsburgh.

soda, and drying under pressure by means of calcium chloride.

The S.S.P. Company proposed to carry out both desulphurization and decarbonatation by an ammonia wash process, working under ordinary pressure. This was accomplished only after some difficulties had been overcome, for the washing of gas with ammonia proved more difficult than might have been expected.

The result of this treatment, however, was excellent, the acid constituents of the gas being reduced to less than 0.1 per cent of carbon dioxide, which is a better result than that obtained with a pressure water wash, the latter leaving as a rule 0.3 to 0.4 per cent carbon dioxide in treating coke oven gas.

The chemical drying of the gas was omitted and left to the refrigerating plant. The hydrogen plant was started up along these lines, but difficulties arose from the presence of heavy, unsaturated hydrocarbons in the gas; these hydrocarbons polymerized in the less cold parts of the hydrogen apparatus and caused obstructions and even local explosions. One apparatus was even partly destroyed.

THOROUGH investigation of the causes of the trouble was made, and it was decided to install a pressure water wash in order to remove all hydrocarbons which had a solubility coefficient higher than one. This proved very effective and the plant has been running smoothly ever since. A few incidents of minor importance, however, have shown it desirable to carry the purification process still further, for the purpose of removing oxides of nitrogen and volatile nitro compounds. A simple physical treatment of the gas has been brought into effect, of which excellent results are expected.

It is generally admitted that in Europe, coke oven gas, a byproduct and the cheapest gas produced by coal distillation, affords the cheapest source of hydrogen. A comparison of coke oven hydrogen and water gas hydrogen in the case of the Ostend plant showed that the latter costs twice as much as the former. This superiority of coke oven gas hydrogen is not necessarily universal, and in localities where cheap power is available, either in the form of hydro-electric power or in the form of very cheap fuel, such as cheap and good lignite, the use of coke oven gas may not be necessarily the most economical; however, according to our latest information, there is not as yet a single plant where water gas is being produced from lignite for hydrogen manufacture. It appears that the famous Winkler producers of the Badische (I.G.) at Leuna produce power gas but not water gas, the latter still being entirely made by means of coke.

FOLLOWING are costs for one cubic meter of hydrogen under Belgian conditions, made by various means. The cost of the process of extraction of the hydrogen from its gaseous prime material is not included:

1 cu.m. of H_2 in water gas (from coke at 170 B.Frs. per ton) 0.2244 B.Frs. or 0.62 American cents.

1 cu.m. of H_2 in water gas (from coal at 188 B.Frs. per ton) 0.214 B.Frs. or 0.59 American cents.

1 cu.m. of H_2 in coke oven gas with the latter at 0.14 B.Frs., when the residual gas is valued at the same price per calorie as the original gas, 0.097 B.Frs. or 0.270 American cents.

Thanks to the cheapness of the hydrogen, and also to the general economy of the Casale synthesis process, ammonia is produced at the cost of about 3.1 B.Frs. or 8.7 American cents per kilogram of nitrogen in the form of ammonium sulphate (including the cost of the sulphuric acid and total operating cost, amortization, etc.) which, according to the information available is considerably lower than the cost price of either the English or German synthetic sulphate. Recently published American figures for water gas synthetic ammonia give 16 cents per kilogram of nitrogen in the form of ammonia, and before the costs of the acid and the transformation into sulphate are added.

MAIN FACTORS in the cost of Linde coke oven gas hydrogen are energy and the cost of the coke oven gas itself. The energy consumption per cubic meter of hydrogen, considered at atmospheric pressure, is 0.335 hp. or 0.246 kw.-hr. The total expenses per cubic meter, exclusive of the cost of the coke oven gas (without nitrogen and at atmospheric pressure) amount to 0.141 B.Frs. or to 0.395 American cents. The cost of the coke oven gas itself obviously depends upon the available market or on the assumption which is made as to its value. Taking the case of the Ostend plant, where gas is sold to the city gas distribution company at the same price per kg. calorie as coal, the cost of gas is calculated as follows:

2.3 cubic meters of coke oven gas at 0.14 B.Frs. per cubic meter equals 0.323 B. Frs. per cubic meter of hydrogen.

HOWEVER, the Linde process returns 70 per cent of the calorific power of the gas as a high-calorific-power gas at 6,500 to 8,000 kg. calories per cubic meter. When allowance is made for the income from this source, counting the hydrogen-free gas at the same price per heat unit as the original coke oven gas, the cost of gas is reduced to $0.30 \times 0.323 = 0.0969$ B.Frs., or 0.27 American cents. The total cost of Linde coke oven gas hydrogen is therefore $0.395 + 0.27 = 0.665$ American cents per cubic meter. The author does not know of any lower cost for hydrogen.

This residual gas consists mainly of methane, ethylene, and their homologues. While it has been evaluated as equal to the original coke oven gas per calorie, it may justifiably be considered of higher worth as it is entirely free of all sulphur compounds and impurities and is absolutely anhydrous. It also lends itself remarkably well to long distance conveyance of gas. The energy economy based on the decreased volume is about 43.5 per cent in favor of residual gas. Yet, the above advantages concern only the crude uses of the rich residual gas, for it lends itself to even more valuable applications, as its different components can be collected separately and used in a whole series of chemical processes to form valuable products.

ASIDE from applications in organic synthesis, the use of methane to increase the available hydrogen has already been worked out commercially by both the Linde and the Casale companies. The process consists in cracking methane into hydrogen and carbon dioxide, by the action of steam and the use of suitable catalysts. This has its use in cases where a large quantity of hydrogen is required from a small quantity of coke oven gas. Indeed, whereas one volume of coke oven gas will yield half a volume of hydrogen, the same quantity of coke oven gas will give 1.7 volumes of hydrogen, equivalent to more

than three times as much ammonia from the gas of a given coke oven battery, when methane is converted into hydrogen. However, it is to be recalled that this may necessitate supplying other gas, perhaps more expensive, for heating the oven.

THE HYDROGEN PLANT built by the Linde company, is a wonder of industrial physics. The purified, compressed gas is cooled in stages, first in a countercurrent cold exchanger, then in a liquid ammonia refrigerator and finally in the fractionating apparatus. This fractionation apparatus effectively utilizes the cold in the condensed gases which are tapped off at various points on the gas circuit as the temperature is lowered. Three fractions are removed, the first consisting mainly of methane, ethane and ethylene, the second of methane and the third of carbon monoxide and nitrogen. The compressed cold gas which is left is now a mixture of hydrogen and nitrogen, but still contains small quantities of methane and carbon monoxide. These impurities are practically eliminated by means of a liquid nitrogen wash, which removes methane entirely and carbon monoxide to such an extent as to leave only 0.001 per cent.

OXYGEN and water vapor are totally removed. There is no process to the author's knowledge, which produces such pure hydrogen from any non-electrolytic gas. For example, in the Claude process, no attempt is made to eliminate the considerable residual carbon monoxide that remains in the gas as it leaves the expansion motor. However, when used with the Claude synthesis process, part of the residual carbon monoxide is turned into methanol in a precatalyst. Also the large amount of methane which is formed in the ammonia catalyst tubes is eliminated with the waste gases, as there is no recirculation.

We now pass to a description of the Ostend type of coke oven gas hydrogen plant. Coke oven gas from the adjoining coking plant, which has undergone the usual treatment for byproduct recovery, is extracted by means of exhausters and is successively washed with an ammonia solution, with water in sufficient quantity to remove the ammonia carried over, then with sulphuric acid which eliminates the last trace of ammonia, and finally with caustic soda which acts as a drier and which fixes any sulphuric acid or carbonic acid which might be left in the gas. The purified gas, after storage, is compressed in two stages to about nine atmospheres. At this pressure it is refrigerated by means of liquid ammonia from the synthesis plant and passed through a cold exchanger where it is warmed up again to about normal temperature. It is now washed with water in pressure water wash towers, where one volume of compressed gas is washed with a little more than one volume of water.

ENERGY of the water as it leaves the pressure towers is recovered in hydraulic turbines placed on the same shaft as the pumps and motors. Dissolved gases, evolved when the pressure has been released, are then collected and returned to the residual gas from the fractionation. As the gas has been very completely decarbonated in the ammonia wash, the object here is mainly to remove acetylene present only to the extent of 0.4 per cent. Small as the amount is, the treatment is, and will remain absolutely necessary until some better means is possible. The gas absorbed consists principally of methane, hydrogen, nitrogen, olefines and smaller amounts of carbon monoxide, ethane and oxygen. The absence of carbon dioxide and hydrogen sulphide shows the effectiveness of the ammonia wash.

Returning to the coke oven gas, which is now purified, it is again refrigerated to a temperature of about —45 deg., when water is removed sufficiently to avoid the freezing of condensed vapor in the fractionating apparatus. The gas now enters the latter and leaves, on the one hand, as a pure mixture of hydrogen and nitrogen with the desired nitrogen percentage for ammonia synthesis, and on the other, as the residual gases which are mixed and after cold exchange, returned to the coking plant to heat the coke oven.

NITROGEN, besides coming partly from the coke gas itself, is introduced by saturation of the hydrogen with nitrogen during the liquid nitrogen wash. The nitrogen proportion is ingeniously regulated by acting on the temperature of the gas, the pressure being kept constant. The temperature itself is regulated by the pressure under which liquid nitrogen is kept in the liquid nitrogen boiler, which constitutes the last stage in the cooling of the hydrogen mixture. A pressure of about 0.2 atm. is maintained in the boiler, the hydrogen mixture itself being under 9 atm.

It has been found useful at Ostend to generate hydrogen with a little less than 25 per cent of nitrogen, and to correct the mixture in each synthesis unit by means of an addition of nitrogen, from the nitrogen machine. The latter produces nitrogen at 99.8 per cent purity and at the same time pure oxygen at 99 per cent.

In passing, it is worthy of note that since the Ostend plant has been started, the Linde company has built a number of installations, treating daily in all more than 2½ million cubic meters of coke oven gas. Besides the extensions to these various plants under preparation, or already being carried out, as at Ostend, several large new installations have been planned. The earliest plants, except for the experimental unit at Oberhausen, were built first in Belgium and then in France, but of late, several large ones have been erected in Germany. It now looks as if the Germans, who apparently at first were content to rely on the I.G. process, are seriously entering the field with the Linde coke oven gas hydrogen process.

ONE FURTHER POINT about the Linde hydrogen-nitrogen process is that it does away with the expensive combustion of hydrogen in air, as applied in certain plants, in order to incorporate the necessary amount of nitrogen into the gaseous mixture. Linde nitrogen requires only 0.2 kw.-hr. per cubic meter in the larger unit, and it would be necessary to secure hydrogen at practically no cost in order to justify using one volume of precious hydrogen in order to obtain two volumes of nitrogen.

The ammonia synthesis plant at Ostend, as has been mentioned above, is based on the Casale system. This system has become very widely distributed in Europe, in Russia and in Japan. About 1,000 tons of ammonia per day are produced by the 24 plants which are at present in operation. These include ten in France, three in Japan, six in Russia, one in Spain, one in Switzerland, two in Belgium (where another large plant is being planned), three in Italy, one in England, one in the United States (it was originally erected at Niagara Falls but it is now being transferred to Belle, Charleston, W. Va.). These plants run on hydrogen from various sources; nine plants use coke over gas hydrogen, ten electrolytic and three, water gas hydrogen.

The Casale process works under a pressure of 750 atm. Despite opinion favoring processes operating at low pressures, in the order of 200 atm. or even less, in the writer's opinion the use of high pressure has very decided advantages. For instance, the whole of the ammonia output is available in liquid form, although the usual huge refrigerating machines are eliminated from the necessary plant. This constitutes a considerable economy of energy. As regards power consumption in compressing the gas, it has been repeatedly shown that there is very little difference in the energy requirement, once the pressure exceeds 200 to 300 atm. For isothermal compression, energy is proportional to the logarithm of the pressure. What little difference there is, is compensated for by the absence of a recirculating pump in the Casale cycle, recirculation being induced by the injection of the fresh gas under a drop of about 50 atm. pressure.

The high pressure equipment of a Casale unit is so compact that it weighs far less than any unit of the same capacity working under a so-called medium or low pressure.

HYDROGEN-NITROGEN mixture produced by the Linde plant is sent to a gas-holder and later exhausted by the six compressors, each compressing 1,000 cubic meters of gas per hour. These compressors have been modified to receive hydrogen as it comes directly under the pressure of 9 atm. from the Linde fractionating apparatus. This arrangement permits of a further energy saving amounting to one-third of the compression energy so that the power requirement is reduced from 1.22 to 0.82 kw.-hr. per kg. of ammonia in the 6-ton unit and to 0.76 kw.-hr. in the 20-ton units. The compressed mixture is admitted without any further purification or desiccation, into the synthesis cycle, which comprises an oil separator, a synthesis tube, a watercooled condenser, and a condensate receiver. Recirculation pumps at Ostend are being replaced by the new injector system mentioned above, which considerably simplifies the circuit and reduces upkeep, attendance and power consumption.

THE most beautiful part of the Casale system is the catalyst tube, so arranged that the pressure tube is kept at a temperature at least 100 deg. below the point where the alteration of the structure of the metal under the effects of hydrogen begins. The efficiency of the design is shown by the fact that a catalyst tube, after three years' continuous service, was tested at 1,500 atm. and withstood the test. The pressure tube is cooled by the incoming cold gases. The catalyst is contained in an annular space in the core of the tube and is thermally insulated from the pressure tube by the concentric heat exchanger and the cold gas.

The reaction is regulated in an ingenious way. As the violence of the reaction would overheat the catalyst at this pressure, sufficient uncondensed ammonia is left in the reaction mixture to make the system just slightly endothermal. It may then be regulated by means of an electrically heated resistance in the catalyst tube. In practice, the heating current is kept constant, the speed of recirculation being regulated so as to maintain temperatures and maintain regular production. The energy consumed by the resistance is from 0.27 to 0.18 kw.-hr. per kg. of ammonia. The presence of the necessary quantity of uncondensed ammonia in the gaseous mixture before catalysis is insured by simply water-condensing the reaction gases. Certainly, no simpler means could be devised.

The catalyst is cheap and robust, rather than a delicate low-temperature proposition. Its manufacture consists in burning steel turnings of a given composition in oxygen, in the presence of certain activators. This drives off any phosphorus or sulphur. When all the metal is burnt, the mass is allowed to cool and is then crushed into pieces of the proper size. The catalyst is introduced into the apparatus in the form of oxide, and is reduced in the catalyst tube by means of hydrogen-nitrogen mixture. Catalyst which has lost some of its activity is regenerated in the same way.

PRODUCTION of ammonium sulphate at first occasioned some difficulties, but these were in a short time overcome, and now 100 tons of sulphate is made per day in one small saturator of about 9 ft. diameter. The sulphate is whizzed and perfectly neutralized with ammonia and is then dried in a rotary drier by means of combustion gases from a coke furnace. This method of manufacturing sulphate will soon be replaced at Ostend by a new process similar to the gypsum process. The system, covered by U.C.B. patents, is special in that it uses an ammonium carbonate solution made in a new way from combustion gases of a central pulverized coal boiler plant. The prime material used in this new process is a valueless byproduct of another industry of the U.C.B. An important feature is that the evaporation of the concentrated sulphate solution, which is the most expensive item of the gypsum process, has been done away with and replaced by a simpler precipitation process.

ALTHOUGH the process has reached great perfection, future improvements will undoubtedly make it even more attractive. For one thing, the whole byproduct recovery will probably soon be replaced by a treatment which will change the method of treatment of ammonia and benzol in the synthesis plant, even in cases where only part of the coke oven gas is to be treated for hydrogen. Ammonia recovery will then take place by means of the above-explained ammonia wash, while debenzolization will be carried out through cooling the compressed gas by means of liquid synthetic ammonia, without the use of the classical refrigeration plant, as the evaporated ammonia has not to be compressed. This type of plant is planned by the U.C.B. for the first Belgian Central Coking plant.

A further simplification which is in view will do away with the pressure water wash. The advantage here of a new special treatment of the gas before debenzolization is that it will greatly simplify the plant, for there will only be refrigeration of the gas preparatory to hydrogen extraction.

AT OSTEND there were at first three 6-ton units; at present there are seven. In the plants which are being planned by the U.C.B. Company, 30-ton units are contemplated, although no unit of this size has yet been built. Experience indicates that a production of 25 to 40 tons may be expected of the 30-ton unit.

To summarize, a new approach to the synthetic ammonia manufacture problem has been opened up, which in practice has proved remarkably satisfactory and cheap. Its development has in turn made possible a series of derived processes, mainly concerned with the transformation of the various residual gaseous byproducts of coke oven gas. Among these, several new syntheses have been attacked, among which are those of the fatty alcohols and of some of their derivatives.

Many Decisions Reached at Fertilizer Conference

Editorial Staff Report

"THE fertilizer industry has become a chemical industry, requiring trained chemists and other technical experts in the supervision of its methods and processes. . . . Your association should in its future activities be guided into a new attitude with new objectives that carry the recognition of this transformation from a waste-product to a manufacturing industry." These were the significant remarks of E. L. Robins, President of the National Fertilizer Association, in his opening address at the Fourth Annual Southern Convention, held November 13 and 14 in Atlanta, Georgia.

Mr. Robins did not limit his comments to generalities. He was very explicit in his recommendations as to needed progress, urging that further radical steps forward be taken promptly and that some additional "impossible recommendations" be adopted and put into effect. As evidence of the practicability of this he cited the adoption and actual carrying into operation of the two recommendations made at a Louisville conference only a little more than a year ago. These were the change in name of acid phosphate to superphosphate and the change from an ammonia basis to a nitrogen basis in reporting of fertilizer analyses. Among the principal recommendations which he made were:

1. That the name "fertilizer" be eliminated both from the Association and technical literature and that the words "plant food" be substituted.
2. That state control laws be modified to permit fair adjustments for fertilizer shipments found not exactly as guaranteed, just as adjustments are permitted for sub-grade cotton, lumber, etc.
3. That fertilizer sales contracts be simplified, eliminating the multitude of protective clauses, which now "carry enough 'whereases' to start a law school."
4. That new sales policies in line with economic fertilizer requirements be established, including the abandonment of trademarked brands which have been regarded as of large asset value whenever newer grades are found of superior agricultural value.
5. That inorganic materials of low unit be substituted for organic nitrogen compounds whose agricultural usefulness is grossly exaggerated and whose real worth is not in proportion to the greater market cost.

TRADE practice conference procedure as organized by the Federal Trade Commission has been determined upon by the fertilizer industry as the best means for further strengthening the code of trade practices adopted by the association two years ago. This procedure was explained to the convention by M. Markham Flannery, director of trade practice conferences of the Commission. Those in attendance at the conference voted unanimously for continued support of the code and affirmed the recommendation of the board of directors for the calling of a trade conference. Arrangements are now being made by Executive Secretary Charles J. Brand. It is hoped that this conference will result in adding the force of Government "policing" of recalcitrant units in the industry to the voluntary self-regulation which has been established under the code. It was pointed out by Mr. Flannery that this policing is done under regulations and trade rules which are adopted by the industry itself and not initiated by the Commission.

Promotion of the welfare of the industry through advertising was the theme for practically an entire session of the convention. Effective planning and the objective of industry advertising were discussed by I. D. Carson, of N. W. Ayer & Son. His conclusions emphasized the two functions of advertising as the bringing of stability and the bringing of security. He stated that "Stability means familiarity of the public with the product, a bulwark against the sudden inroads of sporadic competition—a guarantee of future volume. Security means the confidence of the public—a protection against hasty and unfair legislation. An industry and its policies can be made so well known that it will not suffer from ignorant or unjust attacks by the people or their representatives. All of this has been made possible by the creation of a medium through which the public may be economically reached—powerfully and often. This medium is advertising—the greatest force in modern business."

NITROGEN situation of the world as affecting United States trends was very effectively portrayed in an address by Dr. Firman E. Bear, head of the soils department, Ohio State University. He summarized the recent recommendations made at the Adriatic conference regarding tremendous increases in nitrogen production anticipated during the next four or five years, and pointed out that these insure a more than adequate supply of nitrogen, almost regardless of the rate of increase of agricultural consumption. This increase in nitrogen supply, which is accompanied by a lowering of nitrogen prices, makes the use of nitrogen economically possible on many crops which hitherto could not be so fertilized. Furthermore, Dr. Bear states that "Lower price nitrogen makes it necessary to reconsider the question as to whether legumes are the cheapest source of all the nitrogen required on the farm."

Muscle Shoals, that perennial irritant of the fertilizer industry, was discussed by several representatives of the Association and by Chester H. Gray, the Washington representative of American Farm Bureau Federation. Following an address by Executive Secretary Brand the conference adopted a resolution unanimously advocating the settlement of the Muscle Shoals project in the following fashion: Sale of Wilson Dam and its hydroelectric plant and the associated steam power plant, with the alternative of leasing, or as a third choice, operation by the War Department under the rules of the Federal Power Commission with sale of the power; placing of nitrate plant No. 1 in the hands of the Bureau of Chemistry and Soils of the U. S. Departmnet of Agriculture as a means for experimental chemical and technologic research in nitrogen fixation on a large scale; provision from the income from the sale of power of not more than $750,000 per year for research in fertilization and plant nutrition and the additional sum of $250,000 for the experimental operation of Plant 1; retention of the cyanamide plant, Nitrate Plant No. 2, in stand-by condition for one to three years and, after this period, its sale to the highest bidder.

In his address on this subject Chester H. Gray implied that his organization was continuing its support of the pending Madden bill, which would lease the Muscle Shoals properties to the American Cyanamid Company.

Methods Proposed and in Use for Refining Aluminous Ores

By C. L. Mantell
Consulting Engineer, Pratt Institute, Brooklyn, N. Y.

THE UNITED STATES is one of the largest potential producers of aluminum and pure aluminum compounds. The nation is, however, increasingly dependent on bauxite derived from abroad, chiefly from the Guianas, France and Dalmatia, as a source of raw material for the manufacture of alumina and aluminum hydrate for use in these industries.

In the manufacture of aluminum at present there are two main stages. The first embraces the production of pure aluminum oxide (alumina) from some aluminous mineral, usually bauxite, and the second, the reduction of this aluminum oxide to the metal in a bath of fused cryolite.

Alumina is the raw material for artificial abrasives of the alundum type, as well as certain valuable refractories.

Pure aluminum compounds, such as the sulphate, acetate, and chloride, are also usually made in two stages—first, the pure aluminum hydrate or oxide is prepared, and then by the action of sulphuric or acetic acid on the hydrate, or of chlorine on the oxide, the corresponding pure salt is obtained.

The reason for these two stages is that impurities in the raw materials must be removed. Bauxite, for example, usually contains alumina, iron oxides, silica, and titania. If it be directly electrolyzed or dissolved, a considerable proportion of these impurities will appear in the aluminum or salts. Hitherto it has proved more practicable to make the pure alumina and then the pure metal or salts than to refine an impure metal or purify crude salts.

BECAUSE of the commercial importance of aluminum and its salts, a large number of experimenters have proposed processes for making pure alumina and pure aluminum compounds from various aluminous minerals, such as cryolite, bauxite, clays and kaolins, labradorite, alunite, leucite, shales, feldspar, and others.

In accordance with the principle of the survival of the fittest, the mineral almost exclusively worked for alumina and pure aluminum compounds at present is bauxite. It is worked mainly by the Bayer process for alumina, and by acid extraction for alums and lower grades of aluminum sulphate.

One of the most radically different features of aluminum production as compared with other metals lies in the preliminary treatment of the raw material. The highly technical process and carefully balanced reactions necessary to refine bauxite to alumina are peculiar to this metal. While necessary for the ultimate production of high purity aluminum, they constitute a heavy charge on every ton of metal produced. While the major part of the world's aluminum production is derived from bauxite refined by the Bayer method, the tendency now is to exploit not only other and cheaper processes but more readily available ores. Progress in this direction is being made. It is safe to say that of 20 patent applications for new processes of alumina refining not more than one is industrially practicable. Even so, no very radical change is to be expected. Aluminum will probably never be smelted from its ores like iron. It is not reasonable to expect that it will be electrolytically refined from an aqueous solution like copper. It is believed that the refining of aluminous ores will continue to involve chemical processes of some delicacy, calling for appreciable investment in plant and significant amounts for fuel, labor and reagents. This statement is true whether the raw material be the conventional grades of red bauxite, alunite, leucite, kaolin, labradorite, or any other material.

AMONG processes used or reasonably available for production of high purity alumina are the following:

1—Bayer	5—Berger	9—Halvorsen
2—Hall	6—Serpek	10—Sherwin
3—Pedersen	7—Svendson	11—Laist
4—Haglund	8—Blanc	12—Specketer

These will be briefly discussed in their chemical engineering and economic aspects.

1—Bayer Process. In this process a high grade of bauxite is a necessity. An extremely high grade of alumina is usually produced. Composition of the ore may be as follows:

Al_2O_3	60 — 55 per cent
Fe_2O_3	25 — 20 " "
TiO_2	2 — 3 " "
SiO_2	1 — 3 " "
H_2O and Organic Impurities	12 — 15 " "

The ore is crushed, ground in a ball mill to 70 mesh, mixed with a strong soda liquor, and digested with steam at 60 lb. pressure to dissolve the Al_2O_3. Digestion is carried on in autoclaves at 150 deg. C. for eight hours. The solution is blown into tanks and diluted to a density of about 1.20. It is then filter-pressed, the iron oxide remaining in the residue with most of the TiO_2. From the clear solution of sodium aluminate, the alumina can be precipitated in large tanks or decomposers by slow agitation and the addition of a small proportion of reserve aluminum hydrate. The precipitate is then thickened, washed, dried, and calcined at 1,100 deg. C. in a rotary kiln. In a modification of the Bayer method, the ore is ground, mixed with the appropriate quantity of sodium carbonate, and roasted at about 1,000 deg. C., when sodium aluminate will be formed by decomposition of the carbonate. The solid mass after cooling is

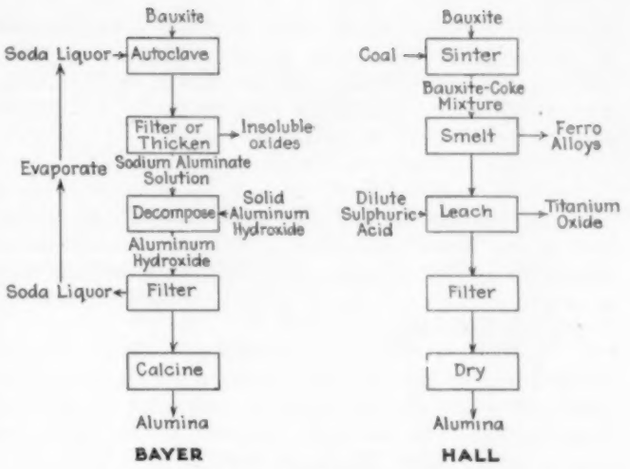
leached with distilled water and the clear liquor treated in decomposers to precipitate alumina, as above.

The Bayer process is technically one of the most difficult to operate and control. The filtration problems alone are perhaps as difficult as those in any other technical process. In addition, the process is expensive. Both in Europe and America the Bayer process has long been in commercial operation. Such plants as those of Aluminum Ore Company, East St. Louis; The British Aluminum Company, Burntisland, Scotland; and Curtius A. G., Duisburg, Germany, are well known. The dry process mentioned above is better known in America, while the autoclave method is generally used in Europe.

AMERICAN practice also favors Dorr type thickeners in place of filter presses for the separations employed, which fact is probably due to the relative cost of labor. The operations are carried out with mechanical exactitude in a well ordered plant. This premises, however, a good and invariable composition of bauxite. Low silica is essential, 3 per cent being the upper limit. The objection to silica lies in its rendering a portion of the alumina insoluble, thus hindering the recovery from a given ore. A good, pure alumina for use in the reduction furnaces contains less than 0.01 per cent FeO.

2—Hall Process. At the beginning of the aluminum industry in the United States, Charles M. Hall devised an electrical method for the refining of bauxite, but the process in an improved form has only just been put into commercial production. Bauxite of graded composition is ground to a granular form and mixed intimately with an appropriate weight of coal similarly ground. The mixture is then sintered at about 1,000 deg. C., cooled, and a further quantity of coke introduced for the purpose of reducing the impurities. The mixture is then smelted in a furnace using electrodes of the Söderberg type at about 2,500 deg. C. Ferro-silicon and ferro-titanium sink to the bottom of the bath and are tapped off. Pure alumina is blown off by steam and air pressure from the top of the furnace into an iron-lined chamber where it is precipitated in flocculent particles similar to popcorn. Contamination by carbides is likely to be the chief difficulty. The alumina after cooling is leached with hot water and dilute sulphuric acid to remove traces of titanium oxide. The solids are filtered in such a way as not to crush or deform the grains. This process is being commercially operated at Badin, N. C., and Arvida, Quebec. The resulting alumina is in the form of solid bubbles. It has only one-third the density of amorphous Bayer alumina. This is advantageous as a charge for the reduction furnaces. As above outlined, the improved Hall process constitutes one of the most important methods of treating bauxite of lower grades than are available for the Bayer process. In the latter, iron and silica are separately removed; in Hall's method, they are removed in combination by simultaneous reduction. Although accurate balance must be maintained in the charge, a silica content greater than 3 per cent is no longer embarrassing.

3—Pedersen Process. Several processes for refining aluminous ores recognize the need for utilizing much lower grades than those which have been commercially feasible heretofore. If the iron content be sufficiently high, it can be smelted out and at the same time silica can be reduced to ferro-silicon, thus leaving the alumina to be slagged off. Such a method is that devised by Professor Pedersen of Trandhjam, Norway. An electric smelting furnace is used. The charge consists of



Flow Charts of the Bayer and Hall Processes

iron ore, limestone and bauxite in the required proportions. Ferrous impurities in the bauxite are smelted out and a richly aluminous slag is obtained. This is tapped off, cooled, crushed and leached with a hot solution of dilute sodium carbonate containing 10 per cent of free caustic for the purpose of accelerating the process and preventing silica contamination.

Obviously the method permits the use of bauxites of high ferrous content which are not economically treatable by the Bayer method. The process is now in operation at the works of the Norsk Aluminum Company, at Hoyangfalden, Norway, where ore of a content of 16 to 18 per cent alumina can be treated, the plant having an annual maximum capacity of 12,000 to 15,000 tons of alumina. This process has been the subject of considerable experimentation by the U. S. Bureau of Mines with the cooperation of the Aluminum Company of America, the object being partly to ascertain whether by using a suitable blast furnace charge an industrially useful aluminous slag could be recovered in addition to pig iron.

THESE TESTS covered a wide variation of slag content of lime, silica and bauxite. No difficulty was found in producing a low sulphur pig iron in conjunction with a slag from which a high grade of alumina could be recovered suitable for use in quick setting cement or for reduction to aluminum. The bauxite charge will be high in iron or silica content according as the object is to yield reducible alumina or cement respectively. In a normal run under conditions on the Eastern seaboard, a production of 1 ton of pig iron and 1½ tons of slag will cost $25 to $30, not allowing any credit in respect to exhaust gases.

4—Haglund Process. Because of the high purity ore required by the Bayer process and the exact balance which must be maintained between the reacting agents, attempts have been made to substitute methods for dealing with lower grade minerals of a wider range of composition. The method of T. R. Haglund, introduced several years ago in Sweden, was developed experimentally in Germany and is now operating commercially in Italy. Aluminous ore, usually bauxite, is crushed and mixed with a due proportion of anthracite and pyrites or other metallic sulphides. The proportions will obviously depend on the iron, silicon, and titanium impurities in the ore. On fusing the mass in a smothered arc or resistance furnace, the iron, silicon and titanium are reduced and tapped off. The slag containing the

aluminum is cooled, when a part of it will crystallize out as alumina, the remainder being aluminum sulphide. The latter amounts to about 20 per cent of the total slag. This is sufficient to hold the alumina in solution at the furnace temperature of 1,100 deg. C.

The main furnace reaction is approximately:

$$Al_2O_3 + 3C + 3FeS = Al_2S_3 + 3CO + 3Fe$$

The outstanding feature of the process is the utilization of the fused sulphide as a flux or solvent for the aluminum and as a means of reducing its melting temperature. The mixed slag is cooled, crushed and leached with water and steam.

$$Al_2S_3 + 6H_2O = 2Al(OH)_3 + 3H_2S$$

After leaching, the residue contains not only the aluminum hydrate but also mixed oxides and sulphides of iron, titanium, etc. The material is treated by classifying and concentrating, when aluminum hydroxide containing a percentage of crystalline alumina is removed. The crystalline alumina is washed with warm sulphuric acid and dried. The hydroxide is then dried and calcined in the usual way. The hydrogen sulphide is condensed and regenerated for sulphurizing a further furnace charge.

IN practical operation of this process, low-grade materials as carboniferous clay, coal dross, and the like are charged. An Italian company has been formed to operate under Haglund patents with a plant near Venice, and one at Mori in the Trentino Valley. It will be seen that pig iron is one of the important byproducts of the process. The market for this and the ferro alloys will have a bearing on the field for Haglund methods.

Primarily Haglund's method applies to bauxite having a silica content too high for treatment by the Bayer process, particularly where the alumina content is correspondingly low. In the diagram it should be noted that the preliminary sulphurization is necessary only where the iron content in the bauxite is high. By this treatment the charge of sulphide can be reduced and the process becomes more nearly regenerative. Where this is not done, th hydrogen sulphide is condensed and the sulphur regained in a Claus furnace.

5—Berger Process. Recent methods for the refining of alumina, as described above, have originated in America, Norway and Sweden. Gerhard Berger and Werner Kuhne, working in Germany, have also developed an apparently practicable process in which the raw material treated is not bauxite but kaolin. For the past twenty-five years attempts have been made to separate the alumina from silica in china clay. In the present process the alumina content is converted to the chloride whence the metal is reduced directly by electrolysis. China clay is broken into lumps of about 6 to 7 lb. each and heated in a reverberatory furnace together with about three times as much iron pyrites. The temperature is maintained at 400 to 500 deg. C. and a current of chlorine gas is passed through the chamber. Aluminum chloride is formed which can be electrolyzed in a fused bath of sodium and potassium chlorides. In the practical operation of the process, magnesium chloride in appropriate amount is mixed with the kaolin-pyrites charge, and a small addition of iron filings is also made. Aluminum chloride gas distills over, leaving behind it the silica of the clay with magnesia and ferrous oxide. In Germany where this process was developed, a high grade of kaolin is obtainable from the Halle district and pyrites from Grafontal and Saalfeld. Magnesium chloride is widely available from the potash mines and takes the place of direct chlorination used on an experimental scale.

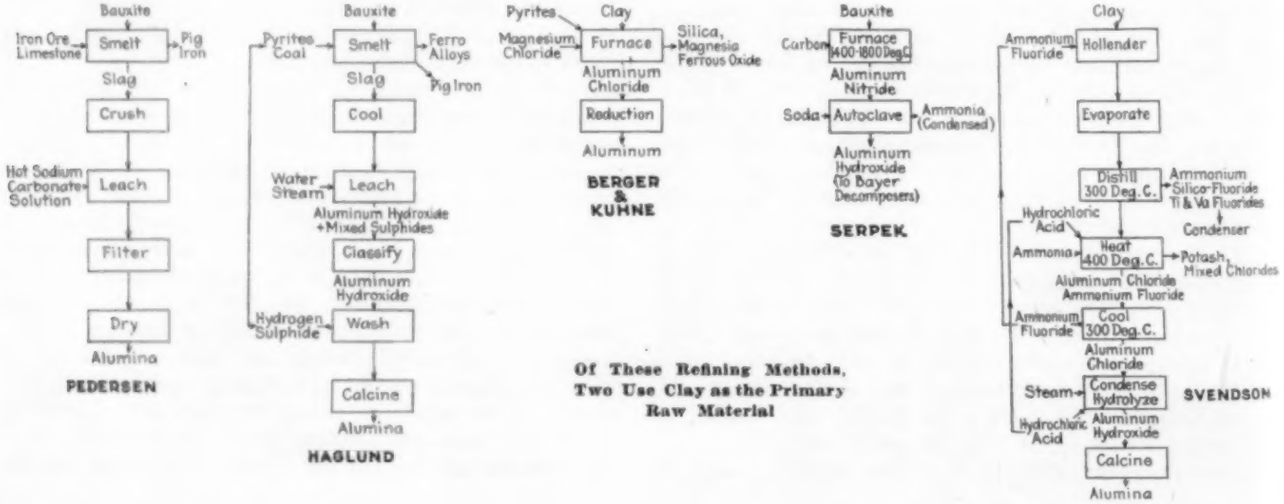
This method was devised at a time when bauxite was not readily available; it is doubtful whether it will compete even in Germany with the present considerable importations of the ore from Hungarian deposits. The evolution of chlorine gas as a byproduct of electrolysis is a feature of the process likely to prove embarrassing. The formation of iron chloride is also a difficulty.

6—Serpek Process. In France the production of aluminum has for many years been carried on by a group having collateral interests in electrochemistry. There has, therefore, been a tendency to refine aluminous ores with due consideration to the development of commercial byproducts. The Serpek process for alumina also yields fixed nitrogen, available for the manufacture of fertilizers or explosives. Bauxite is disintegrated, dried, mixed with crushed carbon, and heated in an electric resistance furnace to 1,600 to 1,800 deg. C. At this temperature the alumina combines with the atmospheric nitrogen and the electrode carbon is oxidized.

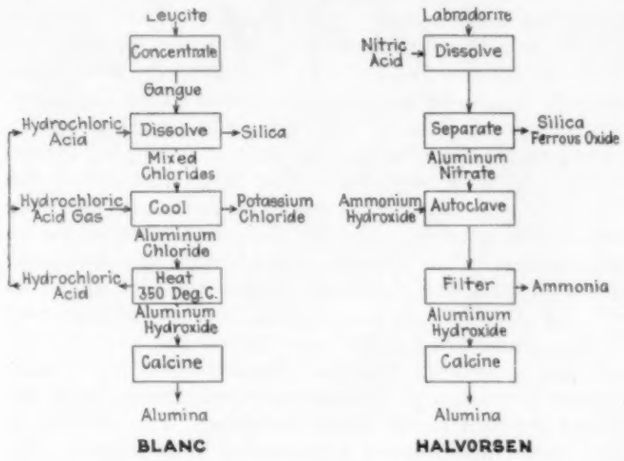
$$Al_2O_3 + 3C + N_2 = 2AlN + 3CO$$

By the use of a suitable catalyst such as steam or iron the reaction will take effect at a temperature about 1,400 deg. C. The chief merit of this process is its extreme simplicity, the raw material being limited to air and carbon. A considerable quantity of electrical energy is consumed, however. The large rotating furnaces designed by Serpek were of 2,500 kw. direct-current capacity. For the production of ammonia, the aluminum nitride is digested in an autoclave under steam pressure.

$$2AlN + 6H_2O = 2NH_3 + Al_2O_3 + 3H_2O$$



Of These Refining Methods, Two Use Clay as the Primary Raw Material



Charts of the Blanc and Halvorsen Processes

Ammonia is condensed and the alumina is regenerated for use in the process. Where alumina is the desired product, however, the aluminum nitride from the furnace is treated with soda under pressure, forming sodium aluminate, and ammonia will be driven off and condensed. The alumina can then be separated by the Bayer method, the solution being fed direct to the decomposers. Because nitride alumina is more easily decomposed, treatment of this material is much cheaper than raw bauxite.

It does not appear that the Serpek process is making any commercial progress in France where the Bayer method continues to be standard.

The Serpek process was investigated during and after the World War by American producers of alumina and was found not to offer sufficient advantages over the standard Bayer process.

7—Svendson Process. A method for the recovery of alumina and a high grade of silica from clay has been developed by Seglund Svendson. The process has been worked on an experimental scale in the United States. A typical clay for treatment by this method should be free from sand and have upwards of 25 per cent alumina, and up to 60 per cent silica, the remaining elements being the usual potash, soda, ferrous oxide, and lime. For a production of 25 tons alumina, 100 tons of anhydrous clay will be required. After crushing, the raw material is mixed in a hollender with ammonium fluoride solution. At a temperature of 36 deg. C. the fluoride decomposes and attacks the clay, ammonium-silica fluoride being evolved. On evaporating part of the fluoride will be decomposed, free fluorine acting on the metallic oxides present. The mixture is then heated to 300 deg. C. in order to volatilize the ammonium-silica fluoride as well as the volatile metallic fluorides mentioned. These are condensed, silica gel being recovered and ammonium fluoride returned to the process.

The original residue containing the alumina is then raised to 400 deg. C. and equal parts of gaseous hydrochloric acid and ammonia are passed. Aluminum chloride, which distills off together with ammonium fluoride, is formed. On cooling, the latter is condensed at 300 deg. C. and the aluminum chloride at 187 deg. C. This last is hydrolyzed with steam, yielding aluminum hydroxide and releasing hydrochloric acid gas. The hydroxide is calcined in the usual way. The most important byproduct is silica gel which is separated from the volatilized fluorides after cooling by the addition of water and ammonia. Basically, the entire process is one for the production of silica gel from clay, aluminum oxide, the other simultaneous product, being produced at only one-third the rate. Economically, the method cannot be used unless there be assured a market for silica three times as great as the required alumina production. It follows, therefore, that the commercial feasibility of Svendson's process depends on the market for silica gel in large tonnages. As the field for this product is being restricted in many of its applications by the competition of activated carbon and other materials, the commercial possibilities seem doubtful.

8—Blanc Process. In Italy, particularly in the region between Rome and Naples, considerable deposits of leucite occur. This is an aluminum-potassium silicate of volcanic origin. The process devised by Baron Blanc and used on an industrial scale by the Societa Italiana Potassa of Rome consists in the conversion of the alumina and potash to chlorides and the separation of these by cooling. The original purpose of the process was to recover potash, but the occurrence of alumina as a by-product has led to the consideration of the Blanc method for a source of metallic aluminum.

In commercial practice the leucite rock is crushed and then concentrated by magnetic separation, leaving the enriched, granulated ore free from iron. The concentrates will have a composition of about 23 per cent alumina, 55 per cent silica, and 18 per cent potash. On treatment with hydrochloric acid, the aluminum and potash dissolve with the evolution of considerable heat. On cooling, potassium chloride is precipitated. At the same time, by passing hydrochloric acid in gaseous form, the aluminum chloride is fixed. After separation the latter is decomposed into aluminum hydrate by heating at 350 deg. C. in iron-lined tanks, and the hydrochloric acid is regenerated. The hydrate is then calcined at 600 to 800 deg. C. When treated with acid most silicates yield a gelatinous solution or colloid from which the silica cannot be separated. Leucite has the merit, when treated by the Blanc method, that the resulting solution can be filtered. It is important that the grains shall be about one millimeter in size, and that the mass shall not be agitated during treatment. The chloride solution is usually recirculated through the mass in order to remove any colloidal silica which may have been carried over.

ON AN industrial scale, leucite is being treated to the extent of 1,500 tons of enriched ore monthly by the Societa Italiana Potassa at Roccamontana. At Bussi there is also a plant handling 400 tons of enriched leucite and producing 140 tons of potassium chloride and 80 tons of aluminum chloride per month, the latter being converted to aluminum by the Societa Italiana de Elettro Chemica. Other activities are evidently planned to increase the use of leucite products. Its present status is mainly that of a source for potash, aluminum being a secondary product. The adoption of the Haglund process by an important aluminum producing group in Italy will tend to limit the scope of leucite treatment.

9—Halvorsen Process. Norway is one of the most important aluminum-producing countries in the world but is unfortunately not endowed with bauxite deposits. Labradorite, which in some respects is a promising source of alumina, is available in large tonnages. Most Norwegian clays contain only 15 per cent of alumina, whereas labradorite averages nearly double this amount. The preliminary treatment devised by Goldschmidt consisted in crushing, grinding, and treating with hot dilute nitric acid in a series of circulating tanks. Silica and the

greater part of the ferrous oxide remain in the residue and the alumina is dissolved. This solution is then heated and evaporated to dryness, whereupon the aluminum nitrate decomposes and water leaching then dissolves out the calcium, sodium and other nitrates, leaving aluminum hydrate. B. F. Halvorsen's method modifies this process by treating the acid solution from labradorite in an autoclave with ammonium salts for about eight hours at 150 to 200 lb. pressure. The precipitate, after drying and heating at 100 deg. to 200 deg. C., is found to be powdered instead of colloidal. It consists of aluminum hydroxide which can be readily washed and filtered. In this way the difficulty of handling a gelatinous precipitate is avoided. The filtrate contains ammonia, which is reclaimed by heating, as well as soluble aluminum silicates.

IT IS interesting to compare this process with the Blanc on leucite. Neither method appears to have been adopted yet as a commercial source of reducible alumina.

10—Sherwin Process. A method of treating low grade or high silica bauxite was devised by R. S. Sherwin as a modification of the Bayer process. It is also claimed that other low grade residues of appreciable alumina content can be similarly treated. The ore is ground and mixed with enough lime to combine with all the silicate present as calcium silicate. Soda ash is also added to one-half the amount required to produce sodium aluminate with the proportion of silica present. The mass is then sintered and afterwards ground and treated with a soda leach, and the temperature held at 80 to 90 deg. C. Sodium aluminate is produced, and the silicate residue remains practically insoluble. Such of the silica as goes into solution can be precipitated by autoclave treatment for two hours at 145 deg. C. From the aluminate liquor, aluminum hydroxide is precipitated by the introduction of stock alumina and agitation as in the regular Bayer method. The Sherwin method has the advantage of rendering low-grade bauxite available for use by the standard Bayer process but at increased cost. No recovery is possible for the lime which goes into the calcium silicate.

11—Laist Process. For a number of years past it has been thought that the alunite deposits of Utah would afford a commercially valuable combined source of potash and alumina. These deposits consist of a hydrous basic sulphate of alumina and potash. In pure samples, potash constitutes 11.40 per cent, alumina 37 per cent, sulphur trioxide 38.60 per cent, water 13 per cent of the total. In the Utah potash industry, it is customary to calcine, leach the potassium sulphate, and evaporate. Treatment of the alumina has been considered difficult due to silica impurity. The Laist method has been devised to recover alumina from clay, but is equally applicable and has been used for the treatment of alunite. It was developed by Frederick Laist, Fred F. Frick, and Robert S. Oliver of the Anaconda Copper Company.

THE CLAY or other form of silicate of alumina is mixed with concentrated H_2SO_4 and heated to 300 deg. to 400 deg. C. Sulphates of alumina, potash, and possibly iron are then leached out with hot water. Iron is reduced to the ferrous state by addition of metallic aluminum. On filtration the insoluble silica is separated. The solution, mixed with hot potassium sulphate, forms potash alum which crystallizes on cooling. Stirring during this stage produces granular crystals of high purity. The alum is now ignited at 1,000 deg. C., when the products of decomposition, oxides of sulphur, are returned to the process and the residue is leached to dissolve out potassium sulphate. Aluminum hydroxide remains and can be calcined to alumina in the customary way.

12—Specketer Process. In this process, which was recently developed by Heinrich Specketer in Germany, clay, leucite, and similar ores are treated with a view to separating the alumina in a pure form and deriving hydrochloric acid as a byproduct. The first treatment of the clay after crushing is with sulphuric acid to dissolve out the metallic content. Sodium chloride is then added to the solution in an amount equivalent to the sulphuric acid contained, and the liquid evaporated and heated to 700 deg. C. At this temperature, sodium sulphate and ferrous aluminum sulphate are formed and hydrochloric acid gas is evolved. For this reaction a rotating tubular furnace is used, and the materials and heating gases are passed through in the same direction. The product is then cooled and leached with water. The alumina and ferric oxide mixture is treated by the Bayer process. A more favorable yield of alumina is obtained in the following modified process. The ore, after crushing, is treated with mixed hydrochloric and sulphuric acids in such proportion that one part of the alumina will be dissolved in sulphuric and two parts in hydrochloric acid. After filtration, salt is added to the solution, which is evaporated, and heated to 500 to 800 deg. C.

The alumina-ferric oxide is sintered with coal at 900 to 1,100 deg. C., cooled, leached with water, and the alumina precipitated from the solution by means of hydrogen sulphide or carbon dioxide. After separation the solution can be causticised with lime to yield caustic soda. Evidently this process has not yet been demonstrated on a commercial scale, nor is it established that the product is sufficiently high in quality for aluminum reduction. It is, however, claimed that the method is cheap in respect to investment, raw materials, and labor.

REVIEWING the 12 processes described, it will be observed that one and one only, the Bayer method, can still be regarded as standard. Notwithstanding all the promising reports in regard to the reduction of clay, alunite, leucite, and other widely distributed ores, little has been done on a commercial scale to displace the treatment of high grade bauxite by an alkaline process. Further, the considerable investment and hazard involved in the installation of a plant for treating clay, together with the uncertainty of the operating results, combine to the disadvantage of such grades of raw material. It is believed that the world's principal producers of alumina are fully protected by ample supplies of high-grade bauxite which can be treated by the Bayer process, and that the bulk of the oxide will be derived in this way for many years to come.

The only new developments of industrial significance are the processes of Hall, Pedersen, and Haglund. All these, however, are dependent on bauxite and not on clay. Somewhat high impurities are permissible as compared with the Bayer process, but even these are subject to strict limits in order to maintain the reacting proportions. Byproducts are sometimes commercially available, but their value should be discounted when estimating the cost of finished alumina; the demand for the main product and byproducts can very seldom be adjusted in the ratio of their production. Both under- and over-production of one material lead to economic loss. The conclusion is inevitable that there is little possibility in the direction of a radical change in methods which would simplify alumina production for the chemical and electrochemical industries.

CEMENT *Industry Conspicuous in Application of Chemical Engineering Principles*

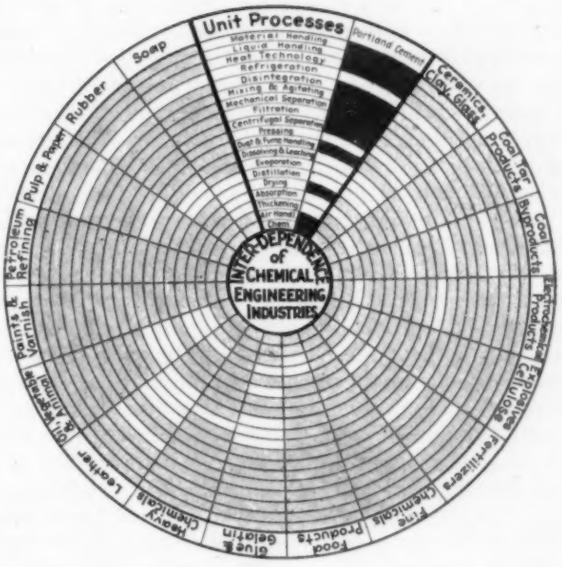
By ROY N. YOUNG
Lehigh Portland Cement Company, Allentown, Pa.

CHEMICAL ENGINEERING as a tool in the development of the cement industry made its debut in 1757 when Smeaton, the builder of the Eddystone Lighthouse in England, was making a search for a suitable raw material to produce a cement which would "resist the extreme violence of the sea." He found that the limestones and chalks which produced the best lime for building in air were not the best for building in water. Through his experiments he discovered that limestones suited for his purpose contained considerable insoluble matter when treated with "aqua fortis"; and that the proportion of the clay matter was an index of the suitability of the material.

From that time to this the rôle which chemistry has played in the growth of the industry probably was of little more importance than that crude application made by Smeaton. It is true that some of the most capable chemists of their day accepted the challenge to answer the questions: What is cement? and what is the mechanism of its behavior when mixed with water? Whether or not the results of their work have had any great influence on the industry is a question, because the few fundamental facts that have been discovered served only to explain partially some of the results already achieved. Therefore the chemistry of cement, so far as the industry is concerned, has been confined to the control of cement composition. This lack of knowledge, however, is not so much an indication of omission as it is evidence of the complexity of the problems.

Although the Portland Cement Association co-operated in important research work through a Technical Research Committee previous to the year 1916, it was not until then that sleeves were actually rolled up in a laboratory by their own organization. During the period that followed, a new era in the use of cement was introduced largely through their efforts. Much was done in teaching the consumer how to use cement and what to expect of it. In turn the consumer, through this increased knowledge, has increased his demands upon cement quality. In 1924 a Portland Cement Association Fellowship with a well-organized staff was established at the United States Bureau of Standards to solve problems pertaining to the constitution of cement and the relation of the constituents to its properties.

Chemical engineering problems in connection with cement manufacture have received some attention by the Association since 1914 but the accomplishments have been largely the results of efforts put forth by individual companies and often were not generally applicable. These activities within recent years are expressive of a realization by the manufacturers of cement that they are employing a chemical engineering process and that a greater knowledge of the product and the fundamentals of the process is a good investment. This attitude has already gained considerable momentum which undoubtedly will further inter-relationship with other industries.



AT FIRST it may seem that the cement industry is very much self-contained with respect to materials and products of other chemical engineering industries, but many instances may be cited to show that this is not the case. Although by far the greater part of the raw materials occur in nature, some byproducts (originally waste products) from other industries are used, e.g., alkali waste and slag. The character and quantity of the natural raw materials consumed makes this industry one of the large users of explosives. Heavy machines, sometimes working under severe heat and dust conditions, demand lubricating materials in quantity and variety. The consumption of both common and high alumina fire brick for kiln linings is no small item of cost. Many millions of cloth and paper bags are purchased yearly. The leather and rubber industries are drawn upon for a large amount of belting even though there has been a strong trend toward the elimination of belts except in the conveying of coarse materials. Chemical reagents, although used in comparatively small quantities, are essential. Of less importance is the use of small proportions of substances such as lime soap or gallotannin which some manufacturers grind into cement chiefly for the purpose of augmenting its waterproofing property in concrete.

PROCESSES employed in the production of cement consists briefly of (1) reducing the raw materials to the desired fineness; (2) blending them to obtain an intimate mixture of the proper chemical composition; (3) burning this mixture to a degree which will practically complete all reactions; and (4) finally grinding the resulting clinker with an added small proportion of retarder. The variety of unit processes employed in cement manufacture is not generally known but these processes constitute the strongest bond between the cement and other industries.

Drying of the raw materials is required whether they are ground dry or wet. If the dry process is used they must be dried before being ground. This is done in direct-fired rotary driers except in case the heat is supplied by waste gases. If the materials are ground wet they are dried in the feed end of the rotary kiln. Rotary driers have been used almost universally in drying coal, but in the last few years upright driers have been installed in a number of plants. These have the advantage of having no moving parts and occupying comparatively small floor space. Also they are designed to operate at low temperatures with a large volume of gas, which makes them highly adaptable for using waste heat. An attempt to adapt the principle of spray drying has been made but without much success. The idea of spraying the wet ground raw material into the kiln has been very attractive to some on the basis that it should increase greatly the rate of heat transfer at the feed end of the kiln and thus lower the waste gas temperature. The chief obstacles have been the increased dust losses and the inability to make a nozzle which would satisfactorily withstand the abrasive action of the slurry. The drying of moist materials during the grinding operation has recently been introduced but it is too early to say what degree of application this system may attain.

GRINDING consumes a large part of the total power required in manufacture of cement. For every ton of cement produced, nearly three tons of materials (including coal) must be ground. The degree of fineness ranges among plants from 80 to 95 per cent passing a 200-mesh sieve with 0.0029-in. square openings. The marked changes in type and size of grinders that have been made in the last few years show that the opportunity for greater efficiency in this operation is not being overlooked. The trend has been toward larger units and the use of tube mills for finish grinding, and particularly the performance of compound grinding by compartment tube mills. Considerable experimental work has been done recently in connection with tube mills which should lead to more economical grinding. Problems are being solved pertaining to shape, size and load of grinding media, type of mill lining, speed and diameter of mill, and wet and dry grinding as affecting efficiency of the mill.

The object in grinding the raw materials is to facilitate the reactions which take place in the kiln. It may be assumed that these reactions should go to completion. Undoubtedly the largest particles are the last to be fully reacted upon and therefore there is a maximum size particle which will react quickly enough at a practical temperature. Furthermore, there is very probably a minimum size particle below which the work expended in grinding is not justified by the advantage gained in the kiln. This suggests closed circuit grinding or preferably some system which will remove the small particle as soon as produced. We do not know yet what the requirements would be, but it is safe to say that full advantage of these principles cannot be attained without much improvement over equipment now in use.

With reference to the finish grinding of cement little information exists regarding the effect of particle size except that finer grinding in open circuit mills results in increased strength of cement so long as quick set is not produced. We know also that coarse particles are comparatively inert but we do not know what particles with respect to size are most effective in giving strength. Would the most effective cement result from a given clinker by producing a uniform optimum particle size or are some of the desirable properties derived from a gradation of sizes? An answer to this question would go far in defining the possibilities in clinker grinding.

CONTROL of the physical properties of a cement starts with the control of its chemical composition. Rarely, if ever, are the raw materials used by a plant sufficiently uniform in composition to be mixed together in fixed proportions. Furthermore, it is seldom possible to maintain a strictly definite chemical composition of the raw mixture by manipulating proportions of ingredients. Fortunately this is unnecessary because it is uniformity of the physical properties of the product that is desired and these may be practically identical among cements of rather widely varying compositions. It should not be inferred however that haphazard variations in composition will not result in a variable product.

Blending of raw materials on a large scale then becomes a necessity. This has been accomplished very simply by grinding the mixture with water to form a slurry with the minimum percentage of water (around 34 per cent) that will allow it to be handled readily with pumps. In principle, the slurry is pumped into tanks or basins, analyzed, and then blended into other tanks to produce the desired composition; but the layout and details of the process vary a great deal among plants. Only very recently has closely controlled blending of dry raw materials been given serious thought. It was a widespread belief that the increasing demands with respect to cement quality would soon make the dry process obsolete. Many dry process plants have been changed to the wet process and nearly all of the newer plants have been designed for the wet process. However it has been demonstrated that perfectly satisfactory blending of dry raw materials can be accomplished at a reasonable cost by intelligent operation of suitable equipment.

MATERIAL handling has an important place in cement manufacture. This will be realized if one considers that each pound of raw material as it advances through the process up to the point of shipment is conveyed and generally elevated no less than ten times and often as many as fifteen times. In addition to this, other materials such as coal in its preparation for the kilns and gypsum must be handled. Among the numerous types of conveying systems that are used, one which was recently developed is unique and deserves special mention. This is the Fuller Kinyon system which successfully conveys and elevates dry pulverized materials through pipe lines of extended length. Air is agitated with the material in a helical screw pump making the material fluffy and capable of being forced through pipes much as a fluid. The many advantages of this system have brought it into common use. Favorable reports have been made of a new conveyor of the torpedo type which is used to trans-

fer coarse materials. It is particularly adapted to the conveying of warm clinker as it is efficient and effective as a means of additional cooling. An improved centrifugal pump appears to be gaining recognition as standard equipment for handling slurry.

AGITATION and filtration processes are used only in treatment of slurry. Continuous or frequent intermittent agitation of slurry is necessary from the time it is ground until it is fed to the kilns, and this interval may be a day or a week. Usually an amount of slurry is kept on hand equivalent to several days' requirements and therefore the agitators should function not only as mixers in the blending process but also to prevent settlement or segregation in storage. Only a combination of mechanical and air agitation has proved entirely satisfactory.

Filtration is a comparatively new unit process for the cement industry. The possibilities for saving of fuel by dewatering the slurry before it is fed to the kiln may be appreciated by consideration of the fact that 25 per cent or more of the total heat supplied to the kiln is consumed in evaporating this water and elevating the temperature of the vapor to that of the exit gases. A number of filters of the rotary type have been installed and reported upon very favorably.

Dust collection was the first operating problem to be investigated by the Portland Cement Association. Dust had been taken as a matter of course until communities in the vicinity of plants began to demand relief from the dust nuisance, and manufacturers began to realize that dust abatement within the plant would bring big returns through increased life of equipment and greater efficiency of the workmen. There are some very dusty plants still in existence but in nearly all of the newer ones adequate attention has been given to this problem.

The Cottrell system for dust precipitation has been most successful in the treatment of hot waste gases from the kilns. In the operation of the first installation it was discovered that the dust collected contained sufficient potash which had been volatilized in the kiln to allow profitable recovery. During the war several plants produced this byproduct but the later depression in prices caused a halt to development in this direction.

COMBUSTION and heat transfer underlie the most important unit operation—the kiln is the heart of the whole process. It is here that the mixture of mineral substances consisting of no less than six major chemical components are made to react to form a heterogeneous clinker of no less than five major constituent compounds. Other compounds are present in clinker, but what they are and what is their effect upon the cement has not been determined. To allow satisfactory operation of the rotary kiln, which is used almost exclusively, the temperature must be kept below the softening point of the mixture and therefore considerable skill is required to maintain conditions that complete the reactions and at the same time prevent the material from becoming sticky. An outstanding exception to this procedure is in the production of high alumina cement where the mixture is fused.

From 450 to 800 pounds of coal are used in the kilns for every ton of cement produced. All this must be dried and pulverized, making its final cost one of the large items in the total cost of the cement. However, only 15 to 25 per cent of the total heat supplied to the kiln is absorbed in the reactions. The remainder is accounted for largely by the sensible heat of the waste gases and clinker, and radiation from the kiln shell. Waste heat is being utilized in the operation of boilers and driers, and also in the preheating of air for combustion chiefly in conjunction with the cooling of clinker. However, much higher efficiency is possible not only through further recovery of waste heat but also through improved heat transfer. Many schemes for the saving of fuel—too numerous to mention—are being experimented with and it is reasonable to expect that rapid advances will be made. Kilns will never become 100 per cent efficient but by increasing a 20 per cent efficiency to 30 per cent the fuel consumption will be reduced one-third.

Several comparisons between the cement and chemical industries as a whole will be of interest. The ratio of capital invested in all chemical industries to the annual value of the products is 0.7, whereas this ratio for the cement industry is 1.6. Wages and salaries paid in all industries are 23.4 per cent of the value of the products against 23.7 per cent in the cement industry. The ratios of cost of materials to value of products for the respective industries are 50 and 60 per cent. These comparisons are corroborative of the statement that the comparatively low price of cement—0.43 cent per pound—is possible only through large scale production and continuous operation. Competition in the cement industry is increasing at a rate that threatens many with eventual failure of profitable plant operation. Lowering of prices, small margin of profit, and competition from without the industry, emphasize the necessity for the application of research to bring about further economies in the process and improvement of the quality of the product.

Mullite Refractories' Heat Expansions Studied

STUDY of the expansion behavior of mullite, prepared from raw materials of various sources, was recently completed at the Bureau of Standards with apparatus described in June in its Technical News Bulletin 134. These materials were four in number:

A—prepared from andalusite

B—prepared from dumortierite

C—prepared from Indian cyanite

D—prepared by electric fusion of necessary alumina and silica for mullite.

The specimens were approximately 6x1x1 inches in size and were all subjected to a firing of at least 1,400 deg. C. prior to the test.

Results of Thermal Expansion Tests on Mullite, 20 to 1,800 Deg. C.

	Maximum Temperatures Deg. C.		Total Expansion at 1,000 Deg. in Per Cent of Unit Length		Contraction Commences at—Deg.		Maximum Expansion Temperature Deg. C.		Maximum Total Expansion in Per Cent of Unit Length	
Run.....	I	II	I	II	I	II	I	II	I	II
Sample										
A.....	1,795	1,800	0.510	0.460	None	1,770	1,795	1,770	1.390	0.995
B.....	1,670	1,730	.495	.495	1,400	1,520	1,400	1,520	.685	.745
C.....	1,795	1,800	.476	.490	1,370	1,700	1,370	1,700	.603	.842
D.....	1,765	1,765	.494	.520	1,425	1,600	1,430	1,600	.767	.840

Peculiarities in behavior of the samples are listed below:

A—Only specimen to show no contraction, rate of expansion increasing decidedly at 1,500 deg. Composed of sizable mullite crystals and some corundum.

B—Nearly uniform expansion rate to 1,500 deg., excepting a sensible increase between 600 and 700 deg. Contained much glass, with mullite, but no corundum.

C—Despite preshrinking at 1,400 deg., shrinking began in first run at 1,250 deg. Second heating caused growth in crystals.

D—Petrographic examination after first heating reveals almost pure mullite, with only minute quantities of glass and corundum.

READERS' VIEWS AND COMMENTS

An Open Forum

The editors invite discussion of articles and editorials or other topics of interest

Increased Tar Distillation Threatens Overproduction

To the Editor of Chem. & Met.:

Sir:—I have read with much interest your article in your November issue, entitled "Steel Corporation Enters Field of Tar Distillation" and should be obliged if you will allow me to make a few observations thereon.

The figures which are given in the first paragraph refer to the consumption of creosote oil in the United States, but later on you state that the importation of foreign creosote oil has decreased and was less in 1927 than in 1926. Evidently consumption of foreign oil is here mistaken for importation, for while in the Bulletin of the Forest Service of the United States Department of Agriculture it is stated that the consumption of foreign oil was 4½ million gallons less in 1927 than in 1926, the importation was 8½ millions greater, the figures being:

Foreign creosote oil imported in 1926: 87,518,544 gal. and foreign creosote oil imported in 1927: 95,915,221 gal. The explanation is given by the difference in stocks held.

As regards the future supply of creosote from Europe, you imply that this will be decreasing, because of the increased quantities of tar that are being used for road making purposes. In Great Britain the saturation point of the use of tar for roads has very nearly been reached and the new production of tar in that country will to a large extent have to find other outlets.

On the Continent of Europe tar is not used for roads to anything like the extent it is in Great Britain and there is room for further use for this purpose. It must not be forgotten however that the production of tar on the Continent is also increasing considerably and the consumption on roads is not keeping step with the increased production. Hence considerably increased quantities will have to be distilled for pitch and creosote oil and there is therefore as far as can be seen no likelihood of any shortage of creosote oil available for export.

As the use of creosote oil, although increasing, is still a limited one, I very much fear that if all the tar, or even the greater part of the tar produced in the United States, were distilled for creosote oil, there would be a considerable over-production. J. A. ROELOFSEN.

President of the Association of Tar Distillers in Great Britain

Dorman Long & Co., Ltd.,
Middlesbrough.

* * * *

Overproduction Danger Considered Remote

To the Editor of Chem. & Met.:

Sir:—In reading Dr. Roelofsen's interesting observations anent the recent article in your publication entitled "Steel Corporation Enters Field of Tar Distillation," we feel that the conclusion he reaches—namely: "if all the tar, or even the greater part of the tar produced in the United States, were distilled for creosote oil, there would be a considerable overproduction"—is undoubtedly correct, and is, we believe, fully understood and appreciated by American tar distillers. In our humble opinion, however, there is little likelihood of this situation arising.

Our reasons for this conclusion are as follows:

(1) Fear of over-production as above;
(2) The open-hearth man's decided preference for tar as a fuel;
(3) The fact that a considerable proportion, probably a major portion, of the tars produced in this country which are particularly suitable for distillation are already being treated.

We should not be surprised, however, to see gradually increasing quantities of tar distilled here to take care of this country's natural consuming increase of creosote and other tar products. Therefore, if, as Dr. Roelofsen states, increasing quantities of creosote oil are to become available abroad, we deem it essential that an increased market for this article should be found there.

This thought is not original with us, however, for we understand that certain perspicacious distillers in England and on the Continent are setting up a pro rata propaganda or advertising fund to encourage the use of this product there. We wish to congratulate them on their foresight and hope that their efforts may be attended with a success comparable to that of our own wood-preserving industry during the past ten years.

H. J. HEMINGWAY.

Robinson, Butler, Hemingway & Company,
25 Broad Street, New York.

* * * *

Diesel Power Sponsored for Electrolytic Processes

To the Editor of Chem. & Met.:

Sir:—I have read with interest Mr. E. B. Dawson's article on "How Direct-Current is Made for Electrolytic Processes." Being concerned with production of this kind I noticed that on page 668 the writer mentions direct-current generation by Diesel engines and then says nothing more about this method. Now it happens that, in the course of my investigations, I have come to the conclusion that direct current produced by the use of Diesel engines costs less than direct-current power produced by the use of purchased alternating current or by the use of steam. Of course, local conditions are the deciding factor in any particular case. I was disappointed that Mr. Dawson has ignored the question of production of direct current for the purpose stated by the use of Diesel engines, and write to suggest that he devote another article to the phase of the question. I regret that I do not agree with him as to the claimed "disadvantages" mentioned on page 671.

LOUIS SIMPSON.

Albert Mines,
Albert County, N. B.,
Canada.

American Industry Contributes to an Historic Flight

To the Editor of Chem. & Met.:

Sir—On page 671 in the November issue of *Chem. & Met.* there is an editorial on "Blau Gas Replaces Gasoline as Fuel in the Graf Zeppelin." The article in itself is quite correct, but it seems to us that you could have boasted a little bit, and justifiably, on the fact that the gas for the return trip was made here in America, that it had all been delivered to Lakehurst before the ship arrived there, it was a better gas than the Germans made initially themselves, pointing out in a definite way that even though the gas was initially a foreign development, as soon as the need arose for doing the same thing here we did a better job than they.

Newspaper reports in our section of the country under date line of Friedrichshafen, Nov. 20th, say that the Germans will make no second trip to America this year, and announce as reason that the necessary supply of gas is not available. We do not know, but we believe this is fuel gas, because certainly hydrogen is always available.

If the *Graf Zeppelin* management had so been inclined, they could have had us send to Germany the necessary quantity of fuel gas, and we would have had it there before the ship landed on its return flight from America. It would of course have been an expensive procedure, but again I think we may take a little justifiable pride in the mere fact that we can do things and can do them promptly and satisfactorily.

When the *Graf Zeppelin* planned its original trip, the management of the ship requested our navy to secure for them a supply of fuel gas for the return trip. The specifications were that the specific gravity should be between 1.03 and 1.08, and the gas should have a heat value of 1,700 B.t.u., the quantity being a million feet.

The Navy didn't find a supply of that particular kind of gas available anywhere, and we undertook to make it. This making was no more or less than construction of a special still for distilling off the heavier constituents of natural gas which we have in ample quantities here in Kentucky, so that we supplied for the *Graf Zeppelin* one million feet of a combustible gas with an average specific gravity of 1.05 and an average heat value of 1,738 B.t.u. Our plant was installed and all the gas manufactured and compressed into cylinders supplied by the U. S. Navy; it was shipped to Lakehurst, in place ready for use before the *Graf Zeppelin* landed here.

This accomplishment in itself is nothing to boast about except that, as I have already indicated, it seems to me a matter of satisfaction to feel that we here in America can make anything that needs to be made as soon as the need arises.

E. G. Luening.
Vice-President and Chief Engineer,
Kentucky Oxygen-Hydrogen Company,
Louisville, Ky.

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The Technical Periodicals Transgress

To the Editor of Chem. & Met.:

Sir—It has always seemed strange to me that "Simplified Practice" does not strike the technical magazine. I personally subscribe for about six of them and read (or glance at) about a dozen more at the office, and always wonder who selected the sizes and why.

Filing of odd sizes of magazines requires special containers or compartments, while to one who merely saves special articles pertaining to his work and needs, filing these in a standard filing cabinet is out of question, unless the pages are cut to the standard size. Having a file built for 8½x11 standard typewriting sheets I find it necessary to trim almost all my magazine savings to fit. Usually the tops of the pages have the most room to cut, so off comes the name of the magazine and the article loses its identity as far as source is concerned. Some magazines have adopted the scheme of putting their name at the bottom of the page, which circumvents my attack. Other magazines are too small in size, stretching articles over several pages, jamming the files and making it necessary to fish for the articles. I am in favor of a standard 8½x11 magazine size, regardless of the originality and uniqueness of other sizes.

Another painful practice is the stretching out of articles all over the magazine, requiring the filing of about half the magazine for one article. I would like to see single articles kept intact without interruption or "continued on another page." Would it not be more just to readers to endeavor to complete each article in its entirety on consecutive pages, rather than string them out along with the advertising?

C. W. Stevens.
Dayton, Ohio.

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A Live Issue Relapses

To the Editor of Chem. & Met.:

Sir—I have just read the inquiry of Mr. Cooper in your August issue regarding gas-fired versus electrically heated crematories for disposal of Hindu dead in the city of Bombay.

It is my understanding that an electric crematory was installed in the Middle West several years ago. The results from this application of electric heating were reported to be unsatisfactory, because of the tendency of the body to coke or char, resulting in very slow and incomplete combustion. Of course, this difficulty might be overcome by the admission of air, but the cost of operation would become prohibitive.

I recall having been asked for a proposal for an electric crematory in one case, but declining to offer any electric furnace. Cremation would seem to be a dead issue insofar as electricity is concerned, and probably is a better application for gas. In our own situation as a combination gas and electric company, we would recommend gas.

Robert M. Keeney.
Connecticut Light & Power Company,
Hartford, Conn.

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To the Editor of Chem. & Met.:

Sir—In the August issue of *Chem. & Met.* A. T. Cooper inquires as to possible use of electric furnaces for cremating, under the heading "Can you do it better with gas?" Without discussing the relative merits of gas and electricity, the fact has been established that the use of gas for cremation is a relatively simple problem, and gas is being used very successfully for that purpose.

In one particular instance, with which the writer is familiar, the usage amounted to 174,900 cu.ft. of 550 B.t.u. gas for 101 cremations. This usage covered a period of three months and four retorts or furnaces. The cost of this would depend entirely upon the comparative rates, and whether it is being done better with gas is also a matter of opinion.

J. H. Gumz.
Pacific Gas & Electric Company,
San Francisco, Calif.

Chemical Engineer's Bookshelf

Rayon Manufacture

The Manufacture of Artificial Silk, With Special Reference to the Viscose Process. By *E. Wheeler*. D. Van Nostrand Company, New York. 150 pages. Price, $5.

Reviewed by Theodore R. Olive

Here is a monograph which any chemical engineer or chemist, as well as the intelligent laymen, may profitably read. Brief as it is, with less than 150 pages of actual text, printed in large type, it is truly surprising to discover the amount of real information for which the author has found space. The information is necessarily a cross section of certain standardized methods, it has a flavor of British practice at some neglect of American, but this is hardly surprising or to be deplored considering the British origin of the book.

The rayon industry is still in its long-legged period. It has only just recently, within the last eight years, emerged from the awkward stage, and its constantly changing viewpoint, its touchiness concerning publicity of a technical nature, its incessant physical change, are characteristic of its adolescence. What is true of the industry today may be well-nigh archaic tomorrow. This condition the author recognizes. He appreciates fully that the technology is practically all of empirical derivation, that methods vary widely from plant to plant, that processes are in a constant state of flux within each plant, and he chooses the happiest medium possible under the circumstances,—just enough in the way of data to give the aspect of authority, while he sedulously avoids debatable points.

As the subtitle of the book suggests, the author concerns himself principally with the viscose process. What little he says concerning the three other most important branches of the industry is disappointingly meager. In pursuit of the main theme, however, he has done a very creditable job. If the rayon technologist will find little that is new to him, that is excusable on the strength of the major premise. Other readers will learn a goodly amount from several chapters devoted to the history and chemistry of the various processes, to their manufacturing features, to the properties of the different types of rayon, their uses, their economics. One feature of considerable value is the inclusion of a number of excellent photomicrographs of various fibers in cross section. Every reader will welcome also the thorough bibliography and the section devoted to the most recent information available at the time of publication concerning the new staple and hollow fibers.

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Survey of Colloid Chemistry

Colloid Chemistry. By *The Svedberg*. 2nd Edition. Chemical Catalog Company, New York. 293 pages. Price, $5.50.

Reviewed by Charles L. Mantell

Basing the text of his monograph on a series of lectures given at the University of Wisconsin during the summer of 1923, the author attempts to give a general survey of colloid chemistry with particular and special attention devoted to laboratory technique. In this respect the book is excellent. Svedberg has placed the emphasis on quantitative rather than qualitative investigations and experiments. In the new edition more space is given to the utilization of the X-ray method of analysis than in the previous edition. The new improvements in laboratory technique have been included, and there is a comparatively complete review of the new methods of colloid analysis by the use of the ultra centrifuge. The recognition of the importance of the Donnan equilibrium and potentials in colloid chemistry has necessitated a revision of the chapter concerning this work.

It is decidedly impressed on the reader that colloid chemistry is more and more becoming a division of physical chemistry and is subject to the same laws, or to extensions of the same laws, when quantitative studies are made.

The second edition suffers from the same defects as the first in that it seems to the reviewer that undue space is given to the author's work at Upsala, while the work of a number of prominent American investigators in the field of colloid chemistry has been badly slighted. For example, the work of Fischer, Holmes, Weiser, Loeb, Thomas, and Bancroft is only slightly mentioned where at all.

The work is divided into four parts: The Formation of the Colloid Particle; The Colloid Particle as a Molecular Kinetic Unit; The Colloid Particle as a Micell; and the last section, consisting of but one page, The Aging and Destruction of the Particle. From an industrial viewpoint, this is perhaps one of the most important divisions of colloid chemistry, yet it is given but one page. The book is a scientific monograph, and the industrial phases are little discussed. The excellence of the book in general allows one to forgive the attitude of the author toward his own work, as well as a certain unevenness in the illustrative material.

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Low Temperature Carbonization

The Technology of Low Temperature Carbonization. By *Frank M. Gentry*. The Williams and Wilkins Company, Baltimore. 1928. 399 pages. Price, $7.50.

Reviewed by Horace C. Porter

Correlating the experiments and investigations in its field and drawing conclusions from them, this book is an excellent compilation of data. In the author's own words, he has endeavored "to co-ordinate the experimental researches of many workers and the expert opinion of many authorities in such a way as to establish the art upon firm technical foundations and thereby overcome the empiricism which heretofore has hindered its progress."

The book should be very useful to engineers and chemists having any interest in fuel technology and the proposed newer methods of utilization involving coal processing. There are eight chapters and 370 pages, not including an excellent bibliography and index. Five chapters, 200 pages, are first devoted to fundamentals and a discussion of the products obtained in low temperature

carbonization. Then follows a chapter of 50 pages describing most of the proposed processes, and an excellent chapter of 60 pages on a subject not often treated adequately in works of this nature, namely operation, design and materials of construction. A 50-page chapter on "Economics and Conclusion" ends the book, and is full of good material on costs, capital and markets, hardly to be expected under the main title of the work.

Under description of the various processes it is necessary, no doubt, that many be omitted, but it is noted here that certain typical ones, e.g., the Plassman or "C.T.G." and the Dobbelstein, applying mechanical pressure in the retort, are not given the mention they deserve.

The author has defined low temperature carbonization, for the purposes of this book, as "the destructive distillation of coal at or below the cracking temperature of the hydrocarbons in the primary tar." He considers this more scientific than the specification of any particular temperature range, and holds that it is the only adequate definition. "Under atmospheric pressure and for average coals, 750 deg. C. may be taken as the upper limit of low temperature carbonization." He fails to explain, however, just what "primary tar" is and that, under the definition given, there could well be a wide latitude in the temperatures used at the wall of the retort, since the hydrocarbons produced by the primary reactions of carbonization are many and varied, and their cracking temperatures range from 450 deg. C. or less to 750 deg. C. or higher. Others have used this definition, however, and it is probably as good as any.

The book is further well illustrated and contains a great deal of numerical data which will be found very useful to those interested in this subject.

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Compendium of Medical Chemistry

CHEMISTRY IN MEDICINE. Edited by *Julius Stieglitz*. The Chemical Foundation, Inc., New York, 1928. 757 pages. Price, $2.

Reviewed by LAURENCE V. BURTON

To bring together in a single volume the best thought in the field of chemistry that has physiological or clinical significance and have it interpreted by the masters of their respective specialties, so that it will be easily available to the field of medicine, Dr. Stieglitz, with an advisory committee consisting of Carlson, Hunt, Lillie, Mendel and Wells, has drawn upon the entire resources of the North American continent to produce this volume. The great and rapid development of chemistry that should be known to the practitioners of medicine, has heretofore been scattered in the voluminous scientific literature of the world and the multitudes of text books that only the biochemist could be expected to be familiar with.

The editors of this book have developed a very logical organization of the vast amount of material from which they have drawn, and have chosen an outstanding worker in each line of endeavor to contribute a well-integrated, comprehensive survey of the achievements that have been accomplished in his field.

Not only has the material been ably presented but it is also very readable, for it has been one of the purposes of the editors that the volume shall be available to the layman as well as to the physician. A glossary of terms is appended that will enable the non-medical reader to understand any of its technical terms.

To review such a work completely is as impossible as it would be to review an encyclopedia; one can only find words of praise for the forty contributing authors whose gratuitous work has been here assembled. Chemists whose active studies of bio-chemistry ceased as recently as three years ago will find this book a stimulating review, for its thought is essentially chemical thought, while the layman of an inquiring mind will be fascinated by its lucid and able presentation.

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Management in Manufacture

LAWS OF MANAGEMENT APPLIED TO MANUFACTURING. By *L. P. Alford*. The Ronald Press Company, New York. 266 pages. Price, $4.

Reviewed by W. S. LANDES

Plant executives will welcome this new contribution on the subject of management as applied to manufacturing. Much has been written concerning management but, as the author points out, amid the complexities of present-day manufacture, the maze of systems and innumerable variations and methods, what executive has not wished for some formulation of the underlying fundamentals which have been developed through the long process of thought and experience?

Just as the progress of science advanced when basic laws were discovered and formulated, so has the success of management been promoted by adherence to fundamental principles. Mr. Alford has gathered together data from all available sources, and expressed these principles in the form of laws. Some of these he offers merely as established facts, based upon years of practice. Others he supports by corrollaries and substantial proof. Still others are stated with the exactness of a mathematical formula.

The book is really the outgrowth of a paper by the author, presented before the American Society of Mechanical Engineers in 1926. Altogether, there are some fifty laws, divided under ten classifications; laws of manufacturing management, leadership, executive work, specialization and standardization, production management, material management, individual productivity, wage payment, safety and maintenance, and economy. The first part of the book deals with the history and progress of management in manufacturing industries in the United States. The contributions of Taylor, Emerson, Gantt, and other authorities are classified and analyzed. In the chapter on leadership, the influence of three outstanding figures in American manufacturing are cited as illustrative of the trend over the last 150 years—Simeon North, George Westinghouse, and Henry Ford. Of special interest is the chapter on laws of economy. Specific formulae are given for the determination of economic manufacturing lot sizes, economic purchase quantities, economy and labor saving equipment, and economy of series.

One of the distinctive impressions of the book, as a whole, is its readability. The presentation is semi-popular, and strictly technical terms are omitted as far as possible. One experiences a feeling of confidence in the author and his knowledge of the subject. He is frank to state where facts leave off and theories begin. The text is replete with references to the work of nearly everyone worth mentioning who has contributed to this important field. There are charts and tabulations, and the author illustrates his point time and again with a short account of what happened in some specific case. Many of these instances have been featured in the pages of "Manufacturing Industries," of which Mr. Alford is the editor. His experience should make him well qualified to assume the

responsibility for propounding the classified information in the form of laws. The book should appeal alike to the planning engineer, junior executive, and seasoned plant manager, especially if he is progressive and striving.

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Keeping Up With Other Sciences

CREATION BY EVOLUTION. A consensus of present-day knowledge as set forth by leading authorities. Edited by *Frances Mason.* The MacMillan Company, New York, 1928. 405 pages. Price, $5.

Reviewed by RICHARD KOCH

Undoubtedly the perennial necessity for urging or "proving" evolution to a vague Somebody must seem strange to those many whom occupation or native bent has endowed with a scientific outlook. The objectors to the theory derive largely from our rural and clerical constituency—groups not otherwise eminent for scientific counsel; its learned proponents, on the other hand, have for some seventy years displayed no signs of retarded success or cause for skepticism. Were this volume, then, just another gratuitous gesture to a class whose convictions never affect the course of science anyway, it would fall quite outside the interest of time-ridden engineers.

This corrective purpose, indeed, purports to underlie the whole book,—happily, though, only on the jacket; in reality its content is instructive rather than educational, stimulating rather than disciplinary. The twenty-four contributing authorities have excellently contrived to devote their allotted sections to pithy accounts centering around the evolutionary aspects of their various "—ologies." Since these subjects are necessarily numerous and since a detailed knowledge of each one lies beyond the hope of normally leisured persons, this opportunity of making at least a brief, reliable and charming acquaintance soon intrigues a curious reader through its entire expanse. In the course of his journey through the book, he assimilates the history and status not only of his variegated terrestrial co-inhabitants, animal and vegetable, but also of their mutual place of abode, this earth. Arriving at its termination he may detect a growing suspicion that the several sciences are all basically kindred, whether in a practical way or in spirit and attitude.

Perhaps this obscure sense of kinship will give technical men a still livelier interest in material not practically available otherwise. This must be their feeling upon learning that the atom and its structure no less than the gigantic planets and sums are involved in evolution; or when Professor Lull indicates the scientific accuracy of certain evolutionary predictions, just as the possibility of chemical processes may be precisely precalculated by thermodynamics.

Conceivably, few will find time available for retrospect into the world's long beginnings, in this day of incomparable industrial activity, with the pace ever quickening and the earth rapidly receiving a new mask. But to those engaged in transforming and practically utilizing the raw material handed down, a reflective moment will come when they will seek to interpret man's now preponderant position amidst his surroundings. If it be true that "nature is made better by no mean but nature makes that mean," then it must be as a growing fraction of nature that man so ingeniously transforms the composition and aspect of his terrestrial home. Certainly this alone should give him a lively curiosity in how affairs were conducted before he set out to take charge of evolution.

WELTPRODUKTION UND WELTHANDEL VON ÄTHERISCHEN ÖLEN. By *H. H. Lander.* Verlag Chemie, G. m. b. H., Berlin. 1928. 400 pages. Price, 15 M.

Previous published work on the essential oils has concerned itself in the main with the technical and scientific phases of production. The present author, however, undertakes to depict the industry solely with an economic eye, to the exclusion of all technical material. In this effort to balance the literature, he accumulates a wealth of official statistical data and arranges his results according to the principal producing countries. These are 70 in number; in each case a discussion of the data and further interesting marketing information precede the actual figures.

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COMMERCE YEARBOOK, 1928—Vol. II, Foreign Countries. Issued by U. S. Department of Commerce. Available from Government Printing Office. 642 pages. $1.50.

A volume giving economic reviews and statistics for foreign countries. This is an enlargement of the similar material which was formerly printed as a part of Commerce Yearbook when it was published in one volume only.

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STATISTICAL ABSTRACT OF THE UNITED STATES, 1928. Issued by the Bureau of Foreign and Domestic Commerce. Available from Government Printing Office. 841 pages. $1.00.

A digest of data collected by all statistical agencies of the U. S. Government, as well as those collected by a number of private agencies and one or two states.

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Newly Published Reports and Texts

AN INTRODUCTION TO QUALITATIVE CHEMICAL ANALYSIS AND THE RELATED CHEMICAL PRINCIPLES. By *D. P. Smith* and *H. K. Miller.* McGraw-Hill Book Company, New York. 275 pages. Price $2.25.

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CHEMICAL REACTIONS AND THEIR EQUATIONS. 2nd edition by *Ingo W. D. Hackh.* D. Blakiston's Son and Company, Philadelphia. 145 pages. Price $2.

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A.S.T.M. TENTATIVE STANDARDS, 1928. American Society for Testing Materials. Philadelphia. 932 pages (185 tentative standards). Price, paper $7, cloth $8.

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ANNUAL INTERNATIONAL TABLE OF CONSTANTS AND NUMERICAL DATA, CHEMICAL, PHYSICAL, BIOLOGICAL AND TECHNOLOGICAL, Volume VI, Parts I and II, for 1923-1924. Gauthiers-Villars & Cie., Paris, and the McGraw-Hill Book Company, New York. 1928. 1675 pages.

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THE MINERAL INDUSTRY OF THE BRITISH EMPIRE AND FOREIGN COUNTRIES. Statistical summary, 1925-27. Published by His Majesty's Stationery office, London. 375 pages. Price, 8s.

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THE CRACKING PROCESSS: A UNIVERSAL SOURCE OF MOTOR FUEL. By *Gustav Egloff.* As presented before the World Power Conferences (Sept. 4-Oct. 6 at London. Universal Oil Products Company, Research Laboratories, Chicago. This authoritative monograph has now been issued as a well-printed well-illustrated booklet of 87 pages. In addition to the text it contains many numerical tables and a bibliography of the industry for 1926 to 1928.

Selections from Recent Literature

TEXTILE PROGRESS. Richard Loewenthal. *Fortschrittsberichte der Chemiker-Zeitung,* Oct. 27, pp. 105-18. A review of progress in the chemistry and technology of natural and artificial textile fibers and fabrics in the years 1919 to 1927; with 294 reference citations. Topics include cotton, bast, wool, silk, rayon, washing and bleaching, dyeing, printing, chemical processing, and fastness of dyes.

PAINT TESTING. A. V. Blom. *Zeitschrift für angewandte Chemie,* Oct. 27, pp. 1178-81. As a new method of testing protective coatings, iron rods are coated, subjected to various test conditions, and then stretched in a tensile machine till the first microscopic signs of failure of the coating appear. This method was developed with the idea that attention should be given to the physical state of the coated surface, and any stresses existing therein, as well as to the state of the coating itself. The new test has, however, broader significance and applicability than its original purpose indicates. Thus, it was observed that the failures grouped themselves roughly in three zones according to age. Fresh films fail only just before the breaking point of the test rod; moderately aged films fail in the plasticity range of the iron, and very old (brittle) films soon after the proportionality limit is passed. Photographs and graphs of test results are shown.

VARNISH FLASHPOINTS. H. L. Hazeltine. *Instruments,* Nov., pp. 471-4. Objection is sometimes made to the standard Clevelean open cup flash point test as applied to varnishes, because the most volatile (most flammable) vapors escape first, without ignition, and hence the observed flash point is higher than the true value. But this test is the closest simulation of the actual conditions obtaining when the varnish is kept ready for use in an open container. The A. S. T. M. closed cup test, on the other hand, gives a close simulation of conditions when varnished articles are baked in an oven having little or no ventilation. This emphasizes anew the importance of adequate ventilation not only in varnish kettles during manufacture, but also in any operations in the use of varnish where the fresh coating is heated. It should be remembered that flash point is not a criterion of the suitability of a varnish for given work, and is not even the only important factor in estimating a fire hazard.

CATALYSTS AND CATALYST CARRIERS. Mark Rabinowitsch and N. Fortunatow. *Zeitschrift für angewandte Chemie,* Nov. 10, pp. 1222-6. A formula is derived, from vapor tension relations of water or other adsorbed liquid, for calculating the porosity of such materials as silica gels and other oxide gels, wood charcoals, activated carbon, graphite, kaolin, porcelain, etc. Porosity and specific surface are important factors in the mechanical strength and effectiveness of these materials when used as catalysts or catalyst carriers; and in some other connections, as in the characteristics of diaphragms for electrochemical uses, absolute size of pores is significant. Numerous tables of data are given for the materials mentioned.

DRYING CERAMIC WARE. Albert Hirt. *La Ceramique,* Nov., pp. 290-7. The advantages and disadvantages of kiln (batch) and tunnel (continuous) drying are discussed. The choice depends on local conditions. It is obviously desirable, if possible, to combine the advantages of both, without their disadvantages, in one drying system. Such a system would necessarily dry in two stages, first with hot moist air in gentle motion, then with hot dry air and active ventilation. It must permit separate control of the two stages, for adapting the treatment to the ware being dried; it must provide for progressive automatic passage from one stage to the other, with automatic charge and discharge within a 24 hour period. It should be simple, requiring a minimum of upkeep, and should eliminate manual labor other than that required to adjust the treatment to changing conditions. The design and layout of such a system are described, with diagrams. While no actual operating results can be reported as yet, sufficient progress has been made to indicate that the new system will successfully meet the requirements set for it in advance.

CAST IRON PIPE. R. J. Disher. *Journal of the American Water Works Association,* Oct., pp. 487-95. There is no correlation between the thickness of cast iron pipe and its service life underground; indeed, thin pipe may last longer than thick, due to its closer grain. Similarly, strength of the pipe has no direct relation to thickness. These facts give an advantage to the horizontal method of casting, which produces thinner, lighter, tougher pipe than vertical casting. Centrifugal casting also gives a light, strong pipe. Modern pipe casting practice is briefly described.

INSULATING OILS. Typke. *Brennstoff-Chemie,* Nov. 1, pp. 346-8. In testing transformer and switch oils for suitability for reuse, the usual tests for new oil (gravity, viscosity, flash point) can be omitted if this is warranted by the known history of the oil. Water content and electrical properties must be measured. Loss in electrical resistance can sometimes be remedied by drying or mechanical refining. Of chemical tests, the most significant is the acid number, which should not exceed 1.0. Miscibility with new oil must also be tested.

STIRRERS. P. Ullrich. *Zeitschrift für physikalisch-chemische Seifenforschung,* Oct. 15, pp. 56-8. Among the most effective stirring devices applicable to soap kettles are the cyclone and the typhoon types. These differ in details of construction, but both operate on the same principle. A propeller at the bottom of the kettle circulates the material in upward flow along the walls and downward flow in the center of the kettle. A floating stirrer arm, arranged to adjust itself at the proper level, breaks up these currents in the upper part of the kettle and thus provides thorough mixing. These are more efficient than older designs of mixers. For thick or pasty soap mixes, column mixers or kneading machines become necessary.

ELECTRIC DRIVES. Ernst Blau. *Chemiker-Zeitung,* Oct. 31, pp. 845-6; Nov. 7, pp. 866-7. Individual electric motor drives for chemical plant machinery have the advantages over shaft transmission drives of better utilization of space, more flexible and adaptable application of power to variable or fluctuating needs, and lower power loss. For example, a direct drive from motor to machine, with accurately cut and properly designed gears of high grade chrome-nickel steel running in a closed oil bath, is almost noiseless and has long service life. A particularly noteworthy example of savings by direct drive is the application of power to the tube mills in cement manufacture. Group drives, as a compromise between the individual drive and the transmission shaft, have both advantages and disadvantages. Illustrated.

AERATION. E. G. Stich. *Chemiker-Zeitung,* Nov. 7, pp. 865-6. The usual system of aeration of yeast vats and other liquid systems is neither efficient nor effective in many cases. For instance, decreasing the size of the bubble outlet holes does not necessarily decrease the bubble size; the predominating factor governing bubble size is the difference in the velocities of escape from the pipe and of rise through the liquid. The stirring effect of aeration is improved when the bubble density reaches the point at which the bubbles rise in a spiral instead of a straight path. Aeration apparatus should be designed to deliver a stream of very fine bubbles (diameter 0.1 to 0.3 mm.). Thus an hourly air input of 6 or 8 times the volume of liquid may suffice, where the older method would require 50 or 60 volumes of air per hour. Illustrated.

CORROSION OF GALVANIZED METAL. W. S. Patterson. *Journal of the Society of Chemical Industry,* Nov. 2, pp. 313-7T. Contrary to common belief, impurities in the Zn coating of galvanized metal do not necessarily hasten corrosion; and so the purer electroplated galvanizing is not necessarily more durable than a hot-galvanized deposit. By actual exposure experiments, a hot galvanized coating is the more durable of the two both in outdoor and in immersion exposure, the immersion bath being dilute KCl. Where the corrosion deposit accumulates on the surface, as in saturated atmosphere

without erosion, the two coatings are about equally durable. In sub-acid corrosion the electrodeposit, on account of its porosity, is much inferior to the hot galvanized deposit, unless made very thick to decrease its porosity.

BOILER CORROSION. R. Stumper. *Korrosion und Metallschutz*, Oct., pp. 217-27. Corrosion in steam generation and use results from four kinds of exposure, namely direct fire, feed water, steam and condensate. Photomicrographs are shown of the graphitization and progressive oxidation of metal exposed to direct fire. The attack on the surfaces exposed to water and steam is governed by chemical and electrochemical factors which include potential and concentration of the materials, and polarization phenomena (primary factors) and properties of the electrolyte and of oxygen, presence of colloids, and catalytic effects (secondary factors). Two stages in rusting are distinguished, namely oxidation to the ferrous and then to the ferric state. The cycle of precipitation and redissolving of Ca or Mg ions in presence of CO_2 may cause corrosion by becoming localized on the boiler wall. The commonest means of preventing or lessening corrosion in boilers is to keep the water constantly alkaline. This must be done with caution, however; if carried too far it defeats its own aim by causing caustic embrittlement. In this connection, the effect of sulphate ions in inhibiting caustic embrittlement may be utilized. The literature of boiler corrosion is reviewed, with 29 reference citations.

FUME PROOF PAINTS. A. Junk. *Korrosion und Metallschutz*, Oct., pp. 230-4. Several priming coats, some with lead pigment and some with iron oxide pigment, were tested for effectiveness as a foundation for paints to resist smoke and fumes. In general, pigments least attacked by smoke or fumes give the best results in priming coats. These include some of the iron oxide pigments, with white lead as a close second. The lead oxides are inferior to white lead; they are attacked and form blisters, which peel and expose the metal to rust. Experiments indicate that no special priming treatment, as with lead pigments, is needed; it suffices merely to apply several coats of the rust-proofing paint itself. No pigments which are not inert should be used; for example, the inert iron pigments should not be mixed with zinc pigments or others which are susceptible to attack.

FERRICYANIDE. H. Paweck and P. Hirsch. *Zeitschrift für Elektrochemie*, Oct., pp. 684-96. A process has been worked out for electrolytic production of potassium ferricyanide without the use of a diaphragm. Three ways of avoiding cathodic reduction without the disadvantages of the conventional diaphragm were tried: increased current density, generating a cathodic diaphragm; mechanical coating of the cathode, e. g. with gypsum; and use of direct current superimposed on alternating current. Tables of data, showing results obtained with these methods, are given. Coatings mechanically applied to the cathode gave marked lessening of cathodic reduction. High current density, with generation of a cathode diaphragm, also gave some good results. The preferred method, however, is to superimpose direct on alternating current. This can probably also be used to avoid anodic oxidation in electrolytic reductions.

Government Publications

Documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. Send cash or money order; stamps and personal checks not accepted. When no price is indicated pamphlet is free and should be ordered from bureau responsible for its issue.

Report of the Chief of the Bureau of Chemistry and Soils for the year ending June 30, 1928. (Report of the Bureau's activities.)

Fertilizer Urea. Preliminary summary of investigation of cost of production. Mimeographed report of the U. S. Tariff Commission.

Linseed Oil. Preliminary summary of investigation of cost of production. Mimeographed report of the U. S. Tariff Commission.

Sodium Phosphate. Preliminary summary of investigation of cost of production. Mimeographed report of the U. S. Tariff Commission.

Rubber Hose Specifications. American Marine Standards Committee specifications on: Rubber Air Hose, AMSC 43; Rubber Steam Hose, AMSC 44; 1½-inch Water Hose, Rubber-Covered, AMSC 45; 2½-inch Water Suction Hose, Smooth Bore, AMSC 46; Oil Suction and Discharge Hose, Rubber Covered, AMSC 47. 5 cents each.

Specifications for Insulation and Related Products. American Marine Standards Committee specifications on: Insulation of Piping and Machinery on Ships, AMSC 35, 10 cents; Magnesia Asbestos Plaster, AMSC 37; Asbestos Millboard, AMSC 38; Hair Felt for Insulation, AMSC 39; Cotton Duck for Insulation Coverings, AMSC 40. 5 cents each.

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World Trade in Wood, Furniture, Floor, Metal, and Automobile Polishes —No. 1, Cuba, by Assistant Trade Commissioner O. R. Strackbein, Habana. This is the first of a group of mimeographed World Trade Notes of the Bureau of Foreign and Domestic Commerce Chemical Division which will deal with this subject. Other areas will be covered by subsequent numbers in this series.

Statistics on Clay Products and Related Commodities. Bureau of the Census preliminary figures in mimeographed form for the 1927 Census of Manufactures on: Glass, Nonclay Refractories, Roofing Tile, Floor and Wall Tile and Similar Tile, Red Earthenware, White Ware, Stoneware and Yellow and Rockingham Ware, Sewer Pipe, Draintile, Firebrick, Common Brick, Face Brick, and Vitrified Brick or Block.

Miscellaneous Census Data. Preliminary mimeographed sheets from the 1927 Census of Manufactures on: Lighting Equipment, Wood Preserving, Printing Inks, Writing Ink, Asbestos Products, Batteries, Soap, Cement, Adhesives, Other than Glue and Rubber Cement, and Leather; Tanned, Curried, and Finished.

Paints and Varnishes. Mimeographed production statistics issued by the Bureau of the Census, giving figures for production and sales, by classes of products for the first half of 1928 and the second half of 1927.

Analyses of West Virginia Coals, by A. C. Fieldner and others. Bureau of Mines Technical Paper 405. 20 cents.

Production of Explosives in the United States During the Calendar Year 1927, by W. W. Adams. Bureau of Mines Technical Paper 435. 10 cents.

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Methods of Preparing and Cleaning Some Common Heavy Liquids Used in Ore Testing, by R. G. O'Meara and J. B. Clemmer. Bureau of Mines Serial 2897.

Ferrous Oxide From Iron and Magnetite, by C. Travis Anderson. Bureau of Mines Serial 2898.

Mineral production statistics for 1927 —separate pamphlets from Bureau of Mines on: Asphalt and Related Bitumens, by G. R. Hopkins and A. B. Coons; Antimony, by J. W. Furness; Abrasive Materials; Mercury, by J. W. Furness; Platinum and Allied Metals, by James M. Hill; Bauxite and Aluminum, by James M. Hill; 5 cents each. Preliminary mimeographed statistics for 1927 on secondary metals.

Mineral production statistics for 1926 —separate pamphlets from Bureau of Mines on: Gold and Silver, by J. P. Dunlop, 10 cents; Copper, by C. E. Julihn and H. M. Meyer, 10 cents; and Coke and By-Products, by F. G. Tryon, H. O. Rogers, and H. L. Bennit, 15 cents.

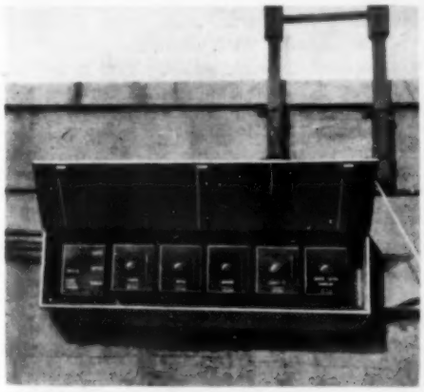
THE PLANT NOTEBOOK
an exchange for OPERATING MEN

Electrical Safety Measures in a New Varnish Plant

By F. A. Westbrook
Center Conway, N. H.

Special methods of installing electrical equipment are a necessity in varnish manufacturing plants, because of the highly combustible and explosive nature of the fumes given off from the raw materials and during the various stages of manufacture. The new and very up-to-date, varnish plant of Baer Brothers at Stamford, Conn., is an excellent example of the sort of care that should be taken. The installation of electrical equipment for both power and lighting was designed by and installed under the supervision of the Adapti Company of Cleveland, which company has given a great deal of attention to this matter and has developed several devices such as vapor-proof push buttons for remote control of motors especially adapted to this kind of service.

In a nutshell, the precautions taken are that all switches, starting boxes and fuse panels be placed preferably on the outside of buildings and never in any room where explosive fumes are present; and that remote-control push buttons be placed in vapor-proof boxes. Consistent with this plan of avoiding possible disastrous results from sparking, all motors used are of the squirrel



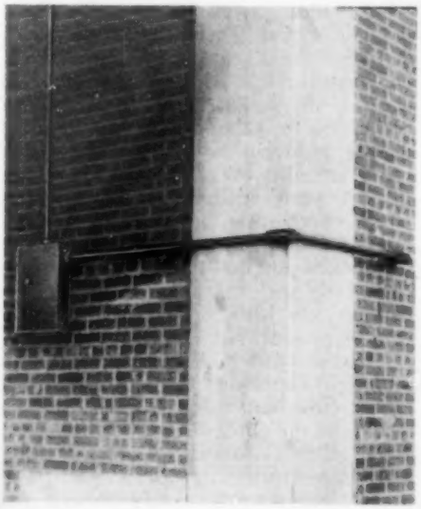
Starting Equipment and Fuse Panel on Outside of Building Where Pumps for Volatile Liquids are Located

cage type. Furthermore, safety disconnect switches have been installed at strategic points on the outside walls so that current may be cut off from the whole plant or from any department as desired.

Now let us see just what this means specifically in this plant. The clearest way to do this is to follow the different electrical feeders to their distribution panels and see what the service is at each.

The main panel is located in a covered passageway between two of the buildings of the varnish plant. The three conductor feeders for this first pass through a Square D safety disconnect switch. It is mounted on the outside wall of the oil storage building and of course controls the whole plant. The conductors entering and leaving it are run through iron conduits. Adjacent to it is the main distribution panel box serving 2,200-volt, 3-phase circuits through fuses to secondary distributing points about the plant.

Conductors to each of these are rubber-insulated and braided and are in iron conduits, except where underground in

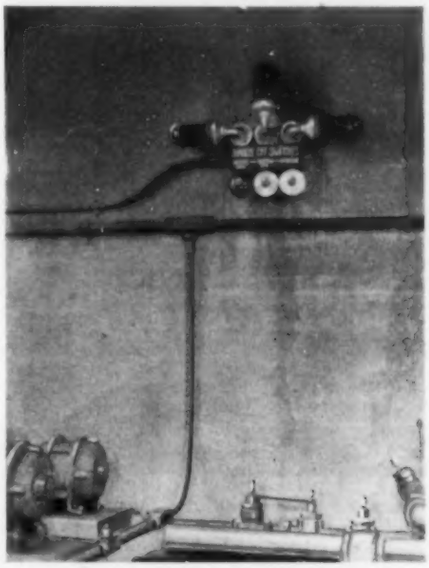


Safety Disconnect Switch on Outside of Varnish Cook House by Means of Which the Flow of Oil and Air to the Fires may be Cut Dead From the Outside in an Emergency

which case lead-covered conductors are used.

Take, first, the service to the tank-basin pump house containing three storage tanks for the volatile liquids used to thin the varnish after it has been through the cooking process. These liquids must be pumped from tank cars to the storage tanks and thence to the reducing room where they are used. There are five motor-driven rotary pumps for this work,—two for unloading tank cars and three for pumping the liquids from the three storage tanks to the reduction room.

All of these motors with their direct-connected rotary pumps are located by themselves in a small fireproof brick building adjoining the tank house. Due to the possibility of small leaks of the



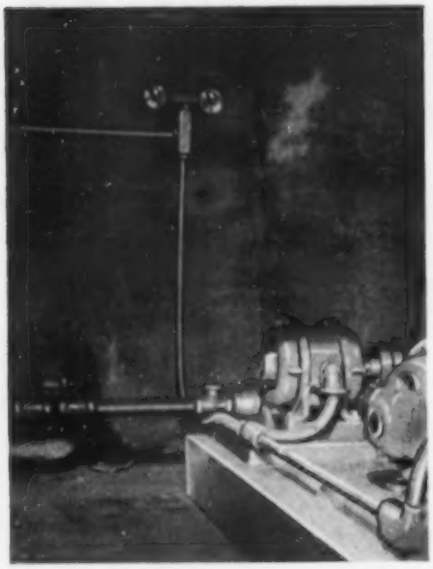
Control Buttons for Motors Operating Pumps Which Deliver Volatile Liquids From Storage to the Reducing Room. Note Pilot lights for Each Control Button

highly volatile and explosive thinners, it is essential that no sparking should occur, for under certain conditions the atmosphere in this room may become very much like that in the venturi column of a carburettor. Consequently the local fuse panel box and the starting boxes for the motors are located in a wooden, weatherproof box mounted on the outside wall of the tank house. Electrical service from the main distribution box is provided by lead-covered wires in underground conduits. The wires to the motors enter the motor room in iron conduits passing through the brick wall. The motors themselves are of the squirrel cage type and the lead wires are completely enclosed in grounded conduits with a final conduit attached to the motor frame. Thus if any breakdown of insulation should by chance occur the arcing will be inside the conduit.

The motors pumping liquid to the reducing room are controlled by vapor-proof push buttons in that room as that is the point of utilization. The conduit and push button associated with each of the three motors used for this purpose are painted a distinctive color. Each push button has marked on it the name of the liquid supplied by the cor-

responding motor and pump and in addition to this each push button has a pilot light which indicates whether the pump is running or not.

This, however, is not all there is to this carefully planned pumping system. Coming back to the fireproof pump room we find three more push button controls marked as in the reducing room and provided with pilot lights. Anyone entering this department can tell at a glance whether any or all of the pumps



Push Button Control for Pumps Used in Unloading Volatile Liquids From Tank Cars. Note Careful Enclosure of Wires

are being run by the reducing-room force. If there is any kind of emergency in the reducing room, the pumps can be stopped here by means of the push buttons. Also, if any of the motors, pumps or pipes at this point or elsewhere are under repair, the motors may be taken off the line by the push buttons thus making it impossible to start them from the reducing room. The push buttons in the pump house then are an emergency as well as a safety precaution.

The two other motors in this house, for pumping thinning liquids from tank cars to storage tanks, are controlled by vapor-proof push buttons mounted on the wall. It is the only point of control for this service and it is the only one needed.

We now come to the building containing the "cook house" and reducing room where the varnish gums are melted and cooked and reduced with the thinners. This is a strictly fireproof brick structure, about three-quarters of which is devoted to space for cooking and one-quarter to the thinning. A fireproof brick partition separates the two sections. Oil burners are used for the cooking fires. There is a fire hazard in the cooking room due to the liability of the varnish igniting, but there is no tendency here toward explosions of vapor. In the adjoining reducing room on the other hand when the cooked varnish is thinned down with highly volatile and flammable liquids, this is anything but the case. Sparks of any kind would be fatal. Keeping in mind these dangerous conditions, let us see how the electrical equipment, consisting of motors, starting boxes and switches, has been installed so as to reduce the hazards to a minimum.

The distribution panel for all motors and lights in the cook room is located on the dividing wall. The feeder coming from the main distribution panel to this panel serving the oil-firing system passes through a safety disconnect switch mounted on the outside wall. In case of any emergency the fires may be stopped electrically from outdoors by simply pulling this switch.

The oil-burning system is served by two duplicate sets of motor-driven rotary pumps and a motor-driven blower. They are located in a small brick wing at the end of the building adjacent to the cook room. Control is by push buttons from the cook room where the starting boxes are also located, being mounted on the wall and connected by iron conduit to the motors. In the pump room, the motors may be cut dead for repairs by push buttons which make it impossible to start them from the cook room.

The most dangerous point in the whole plant is the reducing room. There are three squirrel cage motors here for pumping the varnish before and after reduction to the thinning tank in another building. Of course it is absolutely essential that the starting boxes and disconnect switches be located on the opposite side of the fireproof brick wall in the cooking room. They are controlled by vapor-proof push buttons in the reducing room. In the latter room are also the vapor-proof remote-control push buttons for the motors which operate the thinning fluid pumps. It goes without saying that all wires are in conduits and that the motors leads are completely enclosed. Every possible precaution has been taken to avoid any chance of sparking.

This comprises all but two of the motors in the plant. One of these drives a barrel-washing machine in the storage house and the other is for pumping china wood oil from barrels into indoor storage tanks, but in this case no particular precautions were necessary because the oil is not volatile. It is interesting to reflect that while all of the motors are of insignificant size it has been necessary to install most of them with the greatest possible care on account of the dangers peculiar to the particular service conditions under which they must operate.

The distribution boxes serving the lights in the other buildings are also located on the outside walls within reach of the ground. Within the buildings all outlets, including light switches and convenience outlets are made vapor proof and the wires are run in grounded conduits.

In the room where the final containers are filled with the various varnish products there are a number of portable electrical appliances including two filling machines and a can sealer as well as a portable agitator. These are equipped with small squirrel cage motors and are served by rubber-sheathed flexible cords from special outlets in the lighting circuits. On the second floor of the main building, provision is made in the filter room for operating two portable centrifugal clarifiers from two convenience outlets or from a special power circuit from the main distributing panel.

Novel Tank Transportation

A large southern chemical plant, says *Oxy-Acetylene Tips*, which was located on the bank of a river, found need to expand its production area. As it was closely hemmed in by other plants, further expansion on the main land proved impossible. There was, however, an island in the river at this point, large enough to permit the proposed expansion.

While it was planned to construct a bridge to the island, it was necessary to install a number of large storage tanks on the island before this was done. The tanks, 7 ft. in diameter by 35 ft. long, designed for 200 lbs. per sq.in. working pressure, were of gas-welded construction. They were easily made completely water tight by closing the few outlets. This suggested the idea of floating the tanks across to the island. With this in mind, they were moved on skids to the river bank and slid into the river so that they could be towed across. On the island side it was only necessary to draw the tanks up by means of a rope sling, and skid them to the desired location.

Chemical Burns

In a recent bulletin, the Aetna Life Insurance Company points out a number of the treatments that it recommends for immediate application in the case of various chemical burns. The burns are classified according to acid or alkali source, the former including burns from nitric, sulphuric, muriatic, acetic, oxalic, hydrofluoric, picric, carbolic, and chromic acids. The latter are represented by caustic soda and potash, lime, ammonia and soda ash.

It is suggested that it is always desirable to determine first whether a burn is acid or alkaline. Litmus paper, wet in water should be used. In either case, then, the burn should be well flushed with water after which it is to be neutralized, in case of acid, with 10 per cent soda solution, and in case of alkali, with weak vinegar (or dilute acetic acid). The bathing of the spot with the neutralizing solution should continue for some minutes. The dressing to be used after neutralization is identical with that for ordinary burns.

In certain cases, special treatment is recommended. Chromium burns require immediate treatment with sodium hyposulphite solution. Phenol burns should be washed freely with clean water after which alcohol is applied. Prussic acid burns should be bathed freely in hydrogen peroxide after a thorough water flushing.

EQUIPMENT NEWS *from* MAKER *and* USER

Seen at the Power Show

An important occurrence during the week of December 3, in New York, was the annual Exposition of Power and Mechanical Engineering, where many of the chemical engineering fraternity found a considerable amount of interesting new equipment and devices suited to their needs. Some of these devices, mentioned below, will be described at greater length in future issues of *Chem. & Met.*

WHILE not all of this equipment was shown for the first time, it is all of very recent development. The manufacturers of indicating, recording and controlling instruments have made some valuable new additions. The Brown Instrument Company has developed distant recording for pressure gages. The system applies the company's ordinary inductance bridge principle, wherein the recording instrument may be several miles from the pressure transmitter. The King-Seeley Corporation, Ann Arbor, Mich., demonstrated its new line of distant-reading, indicating, depth gages for tanks. The gages are of the hydrostatic type in which air pressure is used to balance the liquid head in the tanks measured. An equalizer line insures against blowing the indicating fluid from the gage. Another liquid-level gage of the distant-reading variety is the deGiers Liquidometer, made by the Liquidometer Corporation, Long Island City. This gage, supplied in both indicating and recording types, employs a tank float which actuates the indicating mechanism through a balanced hydraulic transmission.

The American Radiator Company, New York, is showing a number of new Mercoid controls, the latest of which is the No. 848 Model B-6, a control for use at pressures up to 200 lb. The range is adjustable, and an accuracy of plus or minus 1 lb. is claimed. The control is obtained through a mercury switch actuated by a flexible metal bellows which responds to the pressure being controlled.

In the weighing field, the Merrick Scale Manufacturing Company of Passaic has extended the field of its "Mechanical Weighman" to cover the weighing of large tanks in the process field. This company has introduced a French scale also, which indicates, prints the weight on a ticket and totalizes. Finally, the last of the indicating instruments is a continuous flammable vapor indicator put out by the Mine Safety Appliances Company of Pittsburgh. This indicates the degree of flammability, or proximity to explosive conditions, of all combustible vapors.

A number of new mechanical devices were shown. The Bethlehem Steel Company has carried the principle of the torque amplifier into new fields and has developed the "Snub-Starter" to take the place of flexible couplings or clutches in direct-connected equipment. This device gradually brings the driven apparatus up to motor speed without permitting an overload on the motor. A second Bethlehem development is a reel drive and tension control for winding paper, rubberized fabrics and similar material. This automatically varies the torque on the reel as the diameter of the wound-up material increases.

A radically new development in speed-changing equipment is introduced by the Crocker-Wheeler Electric Manufacturing Company, Ampere, N. J. Instead of using gearing to obtain either increased or decreased ratios, the two models of the new device employ the principle of rolling friction. The devices are so constructed that an increased load increases the friction and prevents slipping. These devices give a fixed change ratio. The Bronander variable speed unit made by the Scandia Manufacturing Company of Newark, consisting of a type of planetary transmission, when attached to a drive such as the Reeves or Lewellen, permits reversing, stopping and transmitting power at any speed up to full speed of the unit. Another new transmission unit of the infinitely variable speed type is marketed by the Driscoll Sales Corporation, New York. In this transmission a variable lever arm makes it possible to transmit power at any speed from zero up to the maximum capacity of the machine.

HEATING and ventilating equipment had three representatives with new showings. Mid-West Air Filters, Inc., Bradford, Pa., has introduced two models, one horizontal and one vertical, of the "Sinuous" air filter in which the dust-ladened air is forced to follow a specially designed, sinuous path between blades which are flushed with oil for cleaning purposes. Both the Grinnell Company of Providence and the De Bothezat Impeller Company of New York are showing new unit heaters. The former called the "Thermolier," is of the suspended type, in which a special form of exhaust header is said to improve condensate removal. The latter is of the cabinet type, featuring an air distributor at the top, rotated by the flow of air.

Electrical welding demonstrates a new feature recently introduced from England. This is the product of Quasi-Arc, Inc., of New York, who employ a special form of welding rod. The feature of this rod is a covering of aluminum wire over which is wound blue asbestos yarn. This covering melts with the rod and forms a flux over the weld, inclosing the arc and, it is said, protecting the weld metal at the same time, preventing cooling to a certain extent and providing a degree of annealing.

In electrical equipment, there is a new motor by the Howell Electric Company of Howell, Mich. This is a totally inclosed, self-ventilating motor, known as type K, equipped with Timken bearings. The Allen-Bradley Company, Milwaukee, has a new push-button-controlled starting box for corrosive service. An interesting feature is the fume-proof leather diaphragm mounted over, and protecting, the push buttons and the box interior.

A NEW centrifuge has entered the field. This is the Viersen, a German development offered by Hydro Centrifugals, Inc., of New York. These machines are characterized by what is known as the "Camels Hair Clutch" in which camels hair bands, totally without metallic backing, are held in contact with the inside of a drum by centrifugal force and serve as the clutch mechanism. A new extractor of this make is provided with a 30-in. solid basket running at 750 r.p.m. It is adapted to the clarification of shellac, varnishes, and oils.

There are a number of new devices in the field of liquid handling. Special alloy ferrules, which expand to a tight fit when driven into the threaded end of a pipe, have been developed by the Pipe-Saver Corporation of America, of Carthage, N. Y. It is said that these greatly increase the length of life of pipe where weakened by threads. In packing for condenser tubes and shafts, the Crane Packing Company of Chicago has developed a Bakelite-protected metallic packing. This consists of metal foil of suitable material covered with Bakelite varnish and compacted into a ring.

Several new types of valves are in evidence. The Dri-Steam Valve Corporation of New York has a moisture-separating valve which may be used to remove entrainment from exhaust steam used for process purposes. This is a plug type of valve, the plug of which eliminates moisture through centrifugal force set up by numerous turbine blades.

There are two new motor-controlled

valves. The American Radiator Company has developed the "Arco" motor valve which uses a globe valve unit. The valves are furnished in ½- to 2½-in. size. The Cutler-Hammer Manufacturing Co., Milwaukee, has a new motor unit for attaching to valves of 3- to 6-in. size. This may be hand or automatically controlled. Its feature is a special drive which imparts a hammer blow when power is applied to unseat the valve.

Another valve is one of the Y type which is introduced by the Duriron Company of Dayton. This valve, made of Duriron, is supplied in 1- to 4-in. size and features especially straight flow.

Small Dry Quencher

The Dry Quenching Equipment Corporation, 200 Madison Ave., New York, N. Y., has announced a new type C Sulzer dry quencher with a capacity of

Car of Hot Coke Entering Quencher

15 tons of coke per 24 hours, adapted to the needs of the smaller coke oven plant. As in the larger outfits, this unit eliminates the necessity for quenching coke with water, substituting the cooling effect of an inert gas which is passed through the coke and from which the heat is recovered, to a large extent, in a boiler.

The two illustrations show the construction and method of operation of the quencher. The hot coke is put in a special car, the bottom of which is built as a gas distributor. The car is run into a gas-tight steel casing lined with brick where the inert gas is circulated up through the coke and then through a vertical water tube boiler with drums above and below the car and tubes at either side. The coke is cooled down to about 450 deg. F. when about 800 lb. of high-pressure steam has been generated per ton of coke cooled. This cooling period requires about ¾ to 1½ hours. In addition to the saving in heat, dry quenching eliminates the wet quenching nuisance and is said to give a coke which is clean and has an increase in water gas fuel efficiency of as much as 6 per cent.

Cooled Coke Being Withdrawn from Quencher

Car Spotter

In order to eliminate the switch engine and the pinch bar, insofar as possible, the Foote Bros. Gear and Machine Company, Chicago, Ill., has recently placed upon the market a new electrically driven capstan. This is known as the IXL "Hygrade" car spotter. The reduction unit used in each of the two models is a standard Foote Bros. vertical worm-gear reducer. The motor, which is of 5 hp., giving a 3,000 lb. rope pull in the smaller unit and of 10 hp., giving a 6,000 lb. rope pull in the larger unit, is connected to the worm shaft of the spotter through an enclosed spur-gear drive. In operation, it is only necessary to attach a rope to the cars to be moved and take a few turns about the capstan, which can obviously pull in any direction. Considerable savings in time, labor and operating costs are claimed.

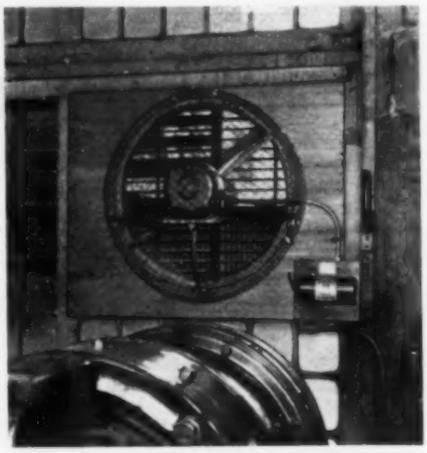
Acid Resisting Roofing

For acid atmospheres which make it difficult to keep an ordinary roof in good condition, a new acid-resisting corrugated asbestos roofing material has been produced by the Asbestos Shingle, Slate & Sheathing Company of Ambler, Pa. Ambler corrugated asbestos roofing is treated with an impregnating compound that protects it from acids and corrosive fumes. This roofing is provided in standard sheets 42 in. wide and of various lengths up to 8½ ft. Its thickness ranges from $\frac{1}{16}$ in. on the ridges and in the valleys to ¼ in. at the center of the slope. It is adapted for use in all types of chemical plant.

Propeller-Type Ventilating Fan

The new Hartzell-Charavay fan, made by the Hartzell Propeller Company, Piqua, Ohio, is made in standard sizes ranging from 1/20 to 1 hp. in single and multi-blade construction with fans of 20-in. to 36-in. diameter. These fan sizes give a capacity range of 2,000 to 18,000 c.f.m.

As shown in the accompanying illustration, a typical fan consists of a supporting ring and frame of aluminum, in the center of which is mounted the motor and the blade. The propeller blade is made of a special alloy having the required lightness and strength. An automatic shutter is provided if needed to close the ventilator opening when the propeller is not operating. Wire guards may be furnished.

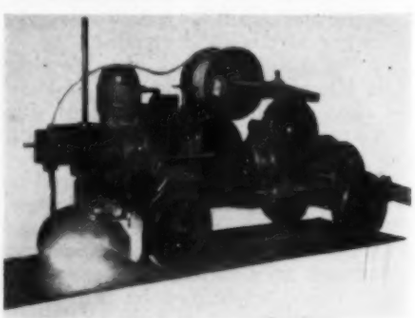


Propeller Fan Cooling a Generator Room

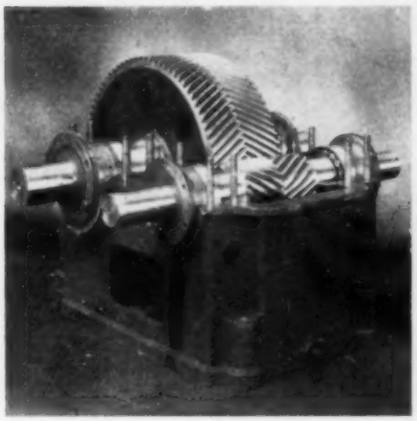
It is claimed that fan deliveries attain efficiencies of at least twice those of blower type fans. For example, a cooling tower installation of Charavay fans connected to a total of 48 hp. replaced four older fans of 40 hp. each. In another case a paper company replaced two 2 hp. disk fans with two 1 hp. propeller type fans.

Automatic Welder

A new application of the electronic tornado welding principle, developed by the Lincoln Electric Company, Cleveland, Ohio, has been announced in the form of an automatic tractor type arc welder which is used for making lap welds and butt welds on large tank bottoms, for large pipes and similar work. As shown in the illustration, this consists of an electronic tornado head mounted on a self-propelled, four-wheel-drive carriage. The power is supplied to it through flexible cable, and when the machine is lined up over the seam to be welded, the electrode and fibrous autogenizer are fed automatically as the tractor travels forward. The principle of the electronic tornado was described in the June, 1928, issue of *Chem. & Met.*



Automatic Tractor Welder



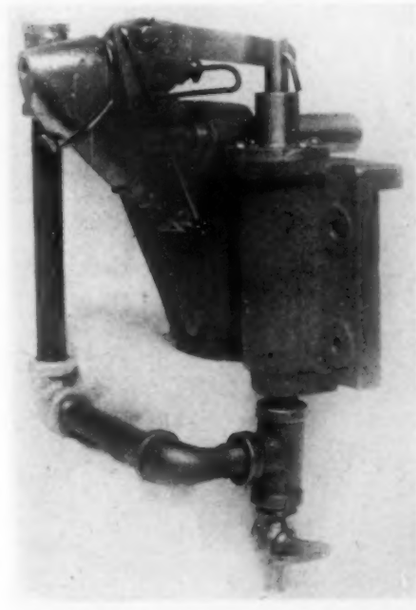
Herringbone-Gear Speed Reducer

New Speed Reducers

A complete new series of speed reducers, which are made with Sykes continuous-tooth herringbone gears and anti-friction bearings in ratings of 1 to 5,000 hp., has been announced by the Farrel-Birmingham Company, Buffalo, N. Y. The new series has roller bearings of a type which combine capacity for carrying radial and thrust loads. Mechanical efficiencies vary between 98½ and 99 per cent for the single reduction and 98 and 98½ per cent for double reduction reducers. One lubricant serves for the entire system. It is claimed that the new series gives a considerable saving in space over the older line of reducers.

New Humidifier Unit

The usual humidifier is a more or less bulky affair of comparatively high cost. This fact has prompted Mid West Filters, Inc., of Bradford, Pa., to develop a new humidifier unit for which many advantages are claimed despite its small size and lack of complexity. The unit requires no power other than the compressed air which is used to atomize water supplied to the nozzle. A principal feature is the self-cleaning device, whereby cleaning needles are pushed into each of the air and water nozzles, by means of a piston and lever, whenever the unit is shut down. It is further pointed out that the units are capable of vaporizing up to 150 lb. water per hour, and that all of the water used is completely vaporized. A control of the units is obtained through a humidistat, which regulates diaphragm valves in the water and air lines leading to the humidifier. When this arrangement has been carried out, the operation of the unit is entirely automatic, and is said to require no attention whatever for months at a time.



Water-Atomizing Humidifier Unit

Recording Spectrophotometer

A new colorimeter, developed by Professor A. C. Hardy, of Massachusetts Institute of Technology, and discussed by him at the recent annual convention of the Optical Society of America, makes possible the accurate analyzing and recording of the characteristics of any color. Through the record obtained, it is possible to duplicate the color at any time. The device eliminates the human equation and automatically measures and records reflecting power of the various wave lengths given off by the colored material, with considerable rapidity and great precision. It should be of interest to makers and users in such fields as inks, paints, dyes, paper, glass, lubricating oils, ceramic materials, leather, and many other products.

In brief, the apparatus consists of a means for analyzing the reflected spectrum from a sample and then measuring the intensity of each minute portion of the spectrum as compared with a standard. This result is recorded as a continuous curve on a chart. The sample and the standard, the latter consisting of magnesium carbonate, the whitest substance known, are illuminated by a special ribbon-filament incandescent lamp. By means of a shutter, a beam from each of the specimen and standard are alternately admitted to the slit of a spectrograph. Each individual line or small portion of the spectrum may be isolated by means of another slit and used to illuminate a photoelectric cell. As the line of monochromatic light then produced will be reflected from each of the standard and the specimen alternately, and as the intensity will differ, the current set up in the photo-electric cell must pulsate. This pulsating current is fed through a vacuum tube amplifier, which increases the power 10,000,000,000 times, to a motor which adjusts a shutter in line with the light beam from the standard. The motor automatically actuates the shutter so as to find a position where the pulsation of the light ceases. The opening of the shutter is hence a measure of the intensity of a particular spectrum line in the specimen compared with the standard.

In operation, adjacent minute portions of the spectrum are successively and automatically compared with the standard and the result recorded. Commercial development of the device is being carried on by the General Electric Company which has taken over the patent rights.

Vertical Speed Reducer

The D. O. James Manufacturing Company, 1120 W. Monroe St., Chicago, Ill., has introduced a new vertical type, heavy duty worm gear speed reducer to permit vertical driving from either top or bottom. All bearings are of the anti-friction type, adapted to take both thrust and radial loads. Worms are of chrome nickel steel machined integral with the worm shaft and gears are of phosphor bronze. The reducer is suggested for such uses as driving agitators, mixers and disk feeders, where it does away with vertical type motors.

Heavy Duty Worm Gear Speed Reducer

Float-Controlled Sump Pump

A new line of sump pumps known as the "American" type MMD, which eliminate flexible couplings and thrust

New Type MMD Sump Pump

bearings, has been developed by the American Well Works at Aurora, Ill. This result is obtained by the use of a hollow motor shaft through which the pump shaft extends so that motor and pump both use the same thrust bearing which is mounted at the upper end of the motor.

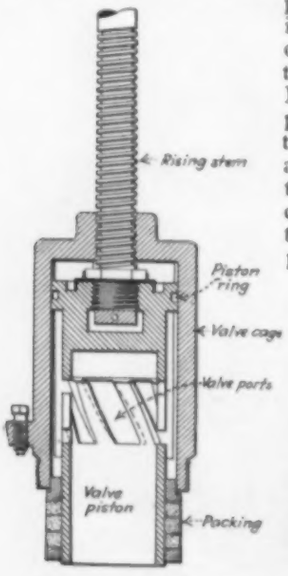
Pumps are supplied for all standard settings up to 17 ft. in either single or duplex units. The pump-supporting pipe is bolted through the pit cover to a cast iron plate that in turn bolts to the motor, thus making the alignment of pump and motor unaffected by distortion in the pit cover.

Herringbone Speed Reducer

A new line of herringbone speed reducers, furnished with anti-friction bearings throughout, is now announced by the Palmer-Bee Company, Detroit, Michigan. These are supplied for single, double and triple reduction, known as the single, double and triple series. Gears are continuous-tooth herringbone with the silent Kysor tooth form. An efficiency of approximately 99 per cent for the single and 97 per cent for the double series is claimed. The construction is such that no outboard bearings are required for over-hung loads up to the maximum rated capacity of the reducers.

Tank Car Valve

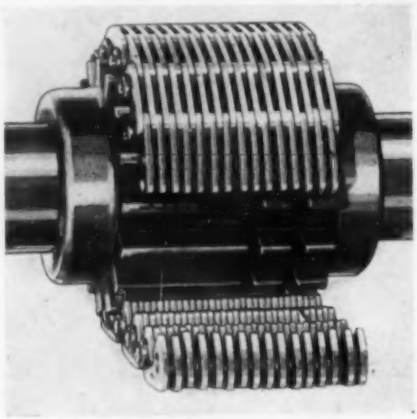
A new Class "A" tank car bottom outlet valve, approved by the Bureau of Standards for unlimited service, has been placed upon the market by the Hills-McCanna Company, 2349 Nelson Street, Chicago, Illinois. The construction of the "Young" valve is clearly shown in the line drawing. The piston is raised and lowered by means of a threaded stem. Closure is effected between the upper end of the piston and the wall by means of several layers of packing set into a recessed cut in the outlet leg. No liquid passes over the packing at any stage of the open or closed position. A supplementary metallic seal in the form of a piston ring is provided to insure tightness in case of emergency. The company is in a position to supply tools for machining existing outlet legs in place in the car, obviating removal of the legs.



Tank Car Outlet Valve

Flexible Coupling

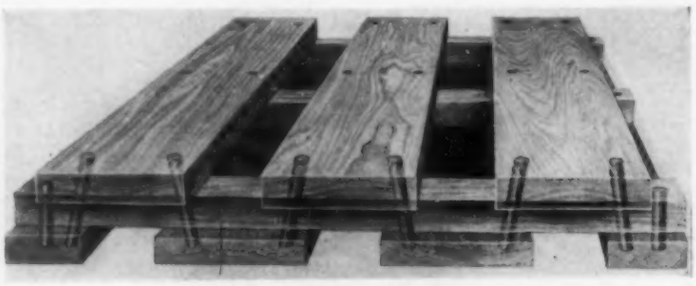
A new flexible coupling for which high efficiency, durability and simplicity are claimed has been developed by the Morse Chain Company, Ithaca, N. Y. This consists primarily of a Morse chain wrapping two sprockets, each one-half of the width of the chain. One has a guide groove in the center of its face to hold the chain in place, while the other has no guide groove and is free to float under the chain. The chain fits loosely enough on the sprockets to take care of ordinary misalignment and lack of parallelism.



New Morse Flexible Coupling

Purifier Trays

Shown in the accompanying illustration is a new type of purifier tray for use in the purification of coke oven gas. It has recently been placed on the market by the Semet-Solvay Engineering Corporation, 40 Rector Street, New York, and is the invention of a practical gas man. Its principal feature lies in the substitution of dowels for metal fittings, so that the construction is entirely of wood with no metal parts to corrode. The manufacturers mention cases where the trays have been in service for nearly two years, and when finally inspected were found to require no servicing whatever.



All-Wood Purifier Tray

Totally Enclosed Motor

A new fan-cooled electric motor of the enclosed type has been introduced by the Cleveland Electric Motor Company, Cleveland, Ohio. It is of the double shell type in which the inner shell completely encloses the motor in a dust-proof manner, while permitting the free flow of air, induced by a fan mounted upon the shaft, between the inner and outer casings. The cooling is said to be so effective that the motor permits practically the same rating for a given frame size as an open type motor.

Water Level Alarm

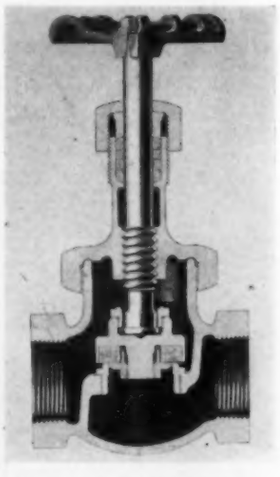
The Signal Engineering & Manufacturing Company, New York, has recently introduced a new high and low water tank alarm system for use in elevated water supply tanks. The equipment consists of a single copper float ball operating a 3-wire high-low level tank switch, a tank bell, a trouble bell, and an indicating control bell. The control panel is enclosed in a steel cabinet with a glass door, and consists of a panel board on which are mounted the necessary switches and instruments, together with properly worded targets which appear only when an indication is necessary.

Differential Hoist

The Chisholm-Moore Hoist Corporation, Cleveland, Ohio, is offering a new direct differential hoist which has been called the "Blue Boy." The hoist is said to be more efficient than former models, and is equipped with Hercules Inswell electric welded load chain which is said to give a high degree of safety.

Resilient-Disk Valve

A new line of valves, including the globe, angle, cross and horizontal as well as angle check patterns of bronze valves equipped with renewable resilient disks for 250 lb. steam working pressure, has been



Resilient-Disk Valve

placed upon the market by Jenkins Bros., 80 White St., New York. The main feature of the valve, the resilient disk, insures a tight seat without regrinding. The valves are provided in sizes ranging from ¼ in. to 2 in. in either flanged or screwed connections. Another feature of the valve, the bonnet construction, is shown in the illustration.

Air Line Filter

A new filter for installation in compressed air lines has recently been placed on the market by the Staynew Filter Corporation, Rochester, N. Y. The filter consists of a felt filter medium formed in pockets over radial wire screen fins grouped about a central outlet. This is inclosed in a pressed steel housing designed to withstand a working pressure of 125 lb.

The type of mounting of the filter element makes it possible to include 20 sq.ft. of filter within a volume slightly less than 1 cu.ft. The filter will hence pass 250 cu.ft. of free air per minute. The manufacturer claims that cleaning of the filter is simple and that this is not ordinarily required oftener than twice a year.

Fire Protection System

As an addition to its other products, the American-La France and Foamite Corporation, Elmyra, N. Y., is now offering a carbon dioxide fire fighting system which is known as "Alfite", which employs liquid carbon dioxide in metal cylinders under a pressure of 900 to 1,000 pounds. When the system is placed in operation, automatically, semi-automatically, or manually as the case may be, a plunger ruptures a copper disk which seals the cylinder and permits the gas to pass through piping to nozzles located at the fire.

The Alfite system is designed to provide 35 per cent dilution of the air in the space being protected. It is said, however, that 17 per cent dilution is sufficient to extinguish flames. It is further claimed that the fire is under control within 30 seconds after the gas is released. The manufacturers state that fires in alcohol, ether, acetone, creosote, and lacquers are all effectively combatted by this means.

Corrosion-Proof Centrifugal Pumps

A new line of non-corroding centrifugal pumps has been developed and placed upon the market by the E. F. Doty Pump Company, Inc., 401 Ellicott Square, Buffalo, N. Y. They are said to be particularly adapted for handling corrosive and viscous fluids and semi-solids and can be equipped with impellers of non-clogging type for handling solids in suspension and stringy or fibrous materials. They may be provided in various corrosion-resisting metals and alloys including the chrome alloys. When necessary special linings such as porcelain, rubber, manganese steel and so on can be furnished.

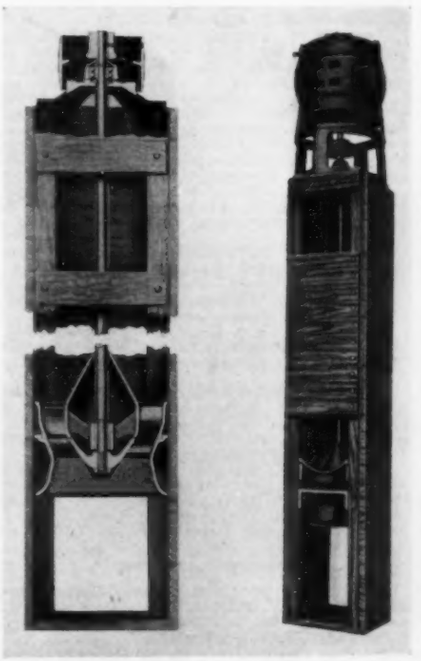
The pumps are equipped with ball bearings and use an over-hung rotor. The casings may be either single or double suction, while the upper half of the casing is removable without disturbing any of the pipe connections. Stuffing boxes are extra long to eliminate packing difficulties. Impellers are of the enclosed type and are said to give an efficiency comparing favorably with water pumping. The pumps are suggested for any corrosive service.

Low Head Pump

For moving large quantities of water or other non-corrosive liquids against a head of 8 ft. or less, Fairbanks, Morse & Company, Chicago, have rerently produced a screw-type pump shown in the accompanying illustration.

The pump is a vertical machine consisting of cast-iron spiders carrying a wood screw type impeller and diffuser mounted within a wooden structure built up on 4x4-in. corner posts. The wooden sidings of two opposite sides may be removed or replaced to vary the head desired.

The pump has been manufactured only in the 24-in. size. It is adapted for direct connection to vertical motors or for belt or gear connection with motors or internal combustion engines. Its capacity at 720 r.p.m., using a 25-hp. motor and pumping against an 8-ft. head is 7,200 g.p.m. This is equal to the output of an 18-in. centrifugal pump, using a 30 hp., 360 r.p.m. motor. The cost of the centrifugal installation, however, is nearly twice that of the screw-type "Everglades" pump. The pump is suggested for such uses as those requiring a large circulating load for agitation purposes.



Low Head Screw Pump for 7,200 G.P.M.

Manufacturers' Latest Publications

Air Compressors. Worthington Pump & Machinery Corp., New York, N. Y.—Bulletin L-620-B1—questions and answers concerning vertical feather-valve compressors.

Apparatus. Leeds & Northrup Company, Philadelphia, Pa.—Bulletin No. 500—concerns equipment for the automatic control of acid baths.

Apparatus. Research Corporation, 25 West 43rd St., New York, N. Y.—Bulletin 203—use of the Cottrell Process for the recovery of sulphuric acid from exit gases.

Apparatus. Schutte & Koerting Company, Philadelphia, Pa. — Bulletin 6-F — describes a flow indicator for pipe lines.

Centrifugal Pumps. Barrett, Haentjens & Company, Hazleton, Pa.—Bulletin 850—automatic operation of suction-lift centrifugal pumps.

Condensers. Schutte & Koerting Company, Philadelphia, Pa.—Bulletin 5-AA—information and data on barometric multi-jet condensers.

Electrical Equipment. Allis-Chalmers Manufacturing Company, Milwaukee, Wis.—Bulletin 1118-E—concerns polyphase induction motors, types AR and ARY.

Electrical Equipment. Century Electric Company, St. Louis, Mo.—Folder describing types RS repulsion-start, induction, single-phase motors and type SC squirrel-cage, induction, polyphase motors.

Electrical Equipment. General Electric Company, Schenectady, N. Y.—Publications as follows: GEA-569B, constant-potential arc welding sets; GEA-881A, gas-engine-driven arc welder; GEA-922, electric equipment for the petroleum industry; GEA-1062, line contacts for group-operated outdoor disconnecting switches; GEA-1066, centrifugal air compressors for sewage disposal systems.

Electrical Equipment. I.T.E. Circuit Breaker Company, Philadelphia, Pa. — Bulletin 220—describing all-steel distribution groups.

Gas Burners. Lee B. Mettler Company, San Fernando Bldg., Los Angeles, Calif.—New catalog of Mettler entrained combustion burners with examples of installations.

Gas Plants. Semet-Solvay Engineering Corp., 40 Rector St., New York, N. Y.—Pamphlets No. 355 and 357, treating respectively the Steere clinkering system and the R. S. de-emulsifier.

Heaters. Aeroil Burner Company, Inc., West New York, N. J.—Bulletin No. 72—describes oil-burning portable burners for various uses throughout the plant.

Heaters. Niagara Blower Company, Buffalo, N. Y.—Bulletin No. 2—a folder describing Niagara fan heaters.

Lubricants. Pfaltz & Bauer, Inc., 300 Pearl St., New York, N. Y.—a bulletin on colloidal graphite lubricants issued by E. de Haën A.-G., Seelze, Germany.

Material Handling. Lewis-Shepard Company, Watertown Station, Boston, Mass. "Jacklift and Stacker Practice"—a folder showing numerous special-purpose lift trucks, stackers and other equipment.

Meters. Esterline-Angus Company, Indianapolis, Ind.—Bulletin 1128—a folder concerning ten new improvements in Esterline-Angus instruments.

Nitrocellulose. Hercules Powder Company, Wilmington, Del.—A reprint of an article, "Nitrocellulose, Recent Developments in Manufacture and Use," by J. B. Wiesel, published in the October, 1928 issue of the *Hercules Mixer*.

Pipe Fittings. Stockham Pipe & Fittings Company, Birmingham, Ala.—Chart-type folder giving the number of pieces per barrel of fittings.

Process Steam. The Marley Company, Kansas City, Mo.—Describes Marley steam purifiers.

Power Transmission. Allis-Chalmers Manufacturing Company, Milwaukee, Wis.—Bulletin No. 1228-H — applications of Texrope drives.

Power Transmission. L. H. Gilmer Company, Tacony, Philadelphia, Pa.—Describing the manufacture and use of V-belts for short-center drives.

Skid Platforms. The Stuebing Cowan Company, Cincinnati, Ohio.—A pamphlet on "Straight Line Trucking," describing the use of lift trucks and skid platforms for shipping.

Speed Reducers. D. O. James Manufacturing Company, Chicago, Ill.—Catalog No. 166—well illustrated catalog of 160 pages covering all types of speed reducers. Also engineering information.

PATENTS ISSUED
Nov. 6 to Nov. 27, 1928

Coal Processing and Combustion

Recirculating Process and Apparatus for Gas Purification. Frederick W. Sperr, Jr., Pittsburgh, Pa., assignor to the Koppers Company, Pittsburgh, Pa.—1,690,438.

Apparatus for Drying or Smoldering Loose Material. Otto Dobellstein, deceased, Essen-on-the-Ruhr, Germany, by Karoline Dobbelstein, administrator, Essen-on-the-Ruhr, Germany.—1,690,444.

Regenerative Coke Oven. Gustav Otto Wolters, Villigst, near Schwerte, Germany. —1,690,805.

Apparatus for Distilling Solid Combustible Carbonaceous Material. Otto Hubmann, Frankfort-on-the-Main, Germany.—1,690,933-5.

Apparatus for Producing Gas and Coke in Alternately-Working Water-Gas Generators. Albert Breisig, Vienna, Austria.—1,691,636.

Gas Producer. Paul Jaworski, Wieldkie-Hajduki, Poland, assignor to the Firm Bismarckhütte, Bismarckhütte/Polnisch Oberschlesien.—1,693,483.

Petroleum Refining and Products

Apparatus for Controlling Cracking Stills. William C. Parrish, Port Arthur, Tex., assignor, by mesne assignments, to The Texas Company, New York, N. Y.—1,690,243.

Cracking of Liquid Hydrocarbons. Owen David Lucas and Ernest Lawson Lomax, Westminster, London, England, assignors to V. L. Oil Processes Limited, Westminster, England.—1,690,416.

Oxidation of Hydrocarbons. Arthur W. Burwell, Chagrin Falls, Ohio, assignor, by direct and mesne assignments, to Alox Chemical Corporation, New York, N. Y.—1,690,768.

Apparatus for Treating Oils. Carbon P. Dubbs, Wilmette, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,690,997.

Process and Apparatus for Fractionating Hydrocarbon Oils. John C. Black, Destrehan, La.—1,692,072.

Motor Fuel and Process of Making Same. Lester Kirschbraun, Chicago, Ill.—1,692,176.

Process of Treating Hydrocarbons. Gustav Egloff, Chicago, Ill.—1,692,203.

Process of Cracking Mineral Oil. Arthur E. Pew, Jr., Bryn Mawr, and Henry Thomas, Ridley Park, Pa., assignors to Sun Oil Company, Philadelphia, Pa.—1,692,786.

Apparatus for Refining Oils. John Primrose, New York, N. Y., assignor to Foster Wheeler Corporation, New York, N. Y.—1,693,156.

Paper, Pulp, Glass and Sugar

Process of Manufacturing Corn Sugar. Charles R. Brown, Kansas City, Mo., and Hubert E. Nelson, Keokuk, Iowa.—1,690,359.

Process and Apparatus for Making Paper. John C. Corcoran, Worcester, Mass., assignor, by mesne assignments, to Argy Pre-Heating Corporation, Niagara Falls, N. Y.—1,690,402.

Process for the Extraction of Cellulose or Paper Pulp from Fibrous Vegetable Matter Containing the Same. Edmondson Spencer, Calcutta, British India.—1,690,954.

Beater for Paper Stock. Charles R. Seaborne, Appleton, Wis.—1,691,308.

Process of Making Chemical Pulp. John S. Bates, Bathurst, New Brunswick, Canada.—1,691,511.

Cane Mill. Franklin Farrel, Jr., New Haven, Conn., assignor, by mesne assignments, to Farrel Birmingham Company, Incorporated, Ansonia, Conn.—1,691,546.

Process and Apparatus for Producing Wood Pulp. Carl Busch Thorne, Hawkesbury, Ontario, Canada.—1,691,682.

Method of Paper Drying and Apparatus Therefor. Alvin E. Montgomery, Oak Park, Ill.—1,691,930.

Method and Apparatus for Handling Broke. Hervey G. Cram, Millinocket, Me., assignor to Great Northern Paper Company, Millinocket, Me.—1,692,113.

Apparatus for Controlling Molen-Glass Flow. Charles B. Kingsley, Clairton, Pa.—1,692,306.

Method and Apparatus for Feeding Glass. Karl E. Peller, Hartford, Conn., assignor to Hartford-Empire Company, Hartford, Conn. —1,692,464.

Method and Apparatus for Producing Charges of Molten Glass. Leonard D. Soubier, Toledo, Ohio, assignor to The Owens Bottle Company, Toledo, Ohio.—1,692,589.

Beating Engine. George Stanford Witham, Jr., Hudson Falls, N. Y.—1,692,602.

Paper and Pulp Making Cylinder Mold. Tom Harvey, Middletown, Ohio.—1,692,733.

Manufacture of Glass. Edward T. Brown, Detroit, Mich., assignor to Ford Motor Company, Detroit, Mich.—1,692,813.

Process of Recovering Resinous Byproducts in the Manufacture of Wood Pulp. Edward H. French, Columbus, Ohio.—1,693,586.

Rubber, Rayon and Synthetic Plastics

Method of Using Latex and Product Thereof. William B. Wescott, Boston, Mass., assignor to Rubber Latex Research Corporation, Boston, Mass.—1,690,150.

Resinous Composition Containing Sulphur and Process of Making Same. Carleton Ellis, Montclair, N. J.—1,690,160.

Composition of Matter Containing a Cellulose Derivative. Harry M. Weber, Montclair, N. J., assignor to Ellis-Foster Company, Montclair, N. J.—1,690,515.

Method of Molding Ebonite Composition. Harold Gray, Akron, Ohio, assignor to The B. F. Goodrich Company, New York, N. Y. —1,691,347.

Process for the Manufacture of Products of Condensation of Urea and Formaldehyde and the Products Thus Obtained. Henri Barthélemy, Paris, France, assignor to Societe Industrielle des Matieres Plastiques, Paris, France.—1,691,427.

Softener for Silk and Process for Making Same. Robert E. Rose, Penns Grove, N. J., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,691,994.

Manufacture of Cellulose Acetate. James William Bulmer, Cullingworth, England.—1,692,622.

Phenol Resin and Process of Making Same. Frazier Groff, Verona, N. J., assignor to Bakelite Corporation, New York, N. Y.—1,693,112.

Process for the Production of the Condensation Products of Phenols with Aldehydes. Grigori Petroff, Moscow, Union of Soviet Socialist Republics.—1,693,461.

Organic Processes

Manufacture of Sulphurized Derivatives of Phenols. Emil Kraus, The Hague, Netherlands, assignor to Fabriek van Chemische Producten, Shiedam.—1,690,640-41.

Process of Making Dipolymer. Irvin W. Humphrey, Wharton, N. J., assignor to Hercules Powder Company, Wilmington, Del.—1,691,065-70, 573.

Process for the Preparation of Anhydrides of Organic Acids. Fritz Doerinckel and Martin Schliemann, Leverkusen, near Cologne-on-the-Rhine, Germany, assignors to I. G. Farbenindustrie A. G., Frankfort-on-the-Main, Germany.—1,691,647.

Explosive. Frank H. Bergheim, Woodbury, N. J., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,691,955.

Process for the Production of Citric Acid. Auguste Fernbach, Paris, France, and John Lewis Yuill, York, England, assignors to Rowntree and Company, Limited, of the Cocoa Works, York, England.—1,691,966.

Catalytic Oxidation of Naphthalene. Alphons O. Jaeger, Crafton, Pa., assignor to the Selden Company, Pittsburgh, Pa.—1,692,126.

Ethyl-Alcohol Substitute and Process for Making Same. Robert M. Isham, Okmulgee, Okla., assignor to Doherty Research Company, New York, N. Y., a Corporation of Delaware.—1,692,662.

Process of Making Tetra-Alkyl Lead. William S. Calcott, Penns Grove, and Herbert W. Daudt, Carneys Point, N. J., assignors to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,692,926.

Inorganic Processes

Lithopone. Frank G. Breyer, Palmerton, and Clayton W. Farber, Bowmanstown, Pa., assignors to the New Jersey Zinc Company, New York, N. Y.—1,690,099.

Process for Treating Gases Bearing Gaseous Synthetic Ammonia. Walter H. Kniskern, Syracuse, N. Y., assignor to Atmospheric Nitrogen Corporation, Solvay, N. Y. —1,690,585.

Process of Making Arsenate of Lime. Carleton Ellis and Vernon T. Stewart, Montclair, N. J., assignors to Chadeloid Chemical Company, New York, N. Y.—1,690,627-8.

Magnesia Product and Process of Making the Same. Thomas S. Curtis, Huntington Park, Calif., assignor, by mesne assignments, to Pacific-Southwest Trust & Savings Bank, trustee, Los Angeles, Calif.—1,690,771.

Process of Making Aluminum Chloride. Almer M. McAfee and Gerald I. Roberts, Port Arthur, Tex., assignors to Gulf Refining Company, Pittsburgh, Pa.—1,690,990.

Process for Producing Pure Lead Carbonate from Crude Lead Sulphate. René Daloze, Uccle, Brussels, Belgium.—1,691,841.

Cadmium-Plating Bath. Arthur White Young and Maurice Emerson Louth, Kokomo, Ind., assignors to Udylite Process Company, Kokomo, Ind.—1,692,240.

Production of Nitric Acid from Ammonia. Lucien H. Greathouse, Clarendon, Va., assignor to Atmospheric Nitrogen Corporation, Syracuse, N. Y.—1,692,298.

Manufacture of Hydrochloric Acid. Edson R. Wolcott, Los Angeles, Calif., assignor, by mesne assignments, to the Texas Company, New York, N. Y.—1,691,452.

Process for the Manufacture of Sulphate of Aluminum. Louis Gabriel Patrouilleau, Paris, France, assignor to Société Alumine et Dérivés, Paris, France.—1,692,692.

Manufacture of Hydrogen. Frank C. Blake, deceased, Wilmington, Del., by Roberta L. Blake, administratrix, Wilmington, Del., assignor to Lazote, Inc., Wilmington, Del.—1,692,811.

Method of Making Hydrogen Chloride and Sodium Sulphate. Charles S. Benjamin, East Orange, N. J., assignor to General Chemical Company, New York, N. Y.—1,693,217.

Production of Sulphur Dioxide and Hydrogen. Charles H. MacDowell, Chicago, Ill., and Herbert H. Myers, Pittsburgh, Pa., assignors to Armour Fertilizer Works, Chicago, Ill.—1,693,244.

Chemical Enginering Processes and Equipment

Method of Making Ceramic Articles. Donald W. Ross and James M. Lambie, Washington, Pa.—1,690,208.

Method and Apparatus for Producing Suspensions. Frederick John Edwin China, Esher, England.—1,690,669.

Process of Treating Liquids. Lyle Caldwell, Los Angeles, Calif., assignor to the Celite Company, Los Angeles, Calif.—1,691,266.

Means for Separating Associated Liquids. Charles W. McKibben, Houston, Tex.—1,691,578.

Process of Producing Emulsions or Dispersions. Lester Kirschbraun, Chicago, Ill., and Harold L. Levin, Passaic, N. J.; said Levin assignor to the Flintkote Company, Boston, Mass.—1,691,765-8.

Process for Performing Chemical Reactions. Charles W. Mortimer, Brooklyn, N. Y. *Heat exchange system.*—1,691,903.

Process of Treating Vegetable Oils. Alexander Schwarcman, Buffalo, N. Y., assignor to Spencer Kellogg and Sons, Inc., Buffalo, N. Y.—1,692,226.

Method and Device for Discharging Chlorine from Tank Cars. William B. Leach, Jr., Niagara Falls, N. Y., assignor to The Mathieson Alkali Works, New York, N. Y.—1,692,847.

Process of Neutralizing the Alkalinity of Water. Alfred H. White, Ann Arbor, Mich. —1,693,065-6.

Process of Preparing Natural Zeolites. Martin F. Newman, Oakmont, Pa., assignor to Wm. B. Scaife & Sons Company, Oakmont, Pa.—1,693,284.

Heat Exchanger. Charles B. Grady, West Orange, N. J.—1,690,108.

Separation of Liquids. Henry Selby Hele-Shaw and Albert Beale, London, England.—1,690,537.

Pulverizing Mill. Louis C. Bonnot, Louisville, Ohio, assignor to the Bonnot Company, Canton, Ohio.—1,690,712.

Welding Apparatus. William P. Shipman, Pittsburgh, Pa., assignor to Blaw-Knox Company, Pittsburgh, Pa.—1,691,501.

Enameling Furnace. Randal E. Talley, Irwin, Pa.—1,692,060.

Electric Furnace. Jacob Weintz, Cleveland, Ohio, assignor to the Strong, Carlisle & Hammond Company, Cleveland, Ohio.—1,692,478-9.

Centrifugal Disintegrator for Liquids. William Spencer Bowen, Westfield, N. J.—1,692,617.

Crushing, Grinding, and Refining Machine. Swinfen Bramley-Moore, White Plains, N. Y.—1,692,884.

Pumping and Metering Apparatus. Thomas A. Banning, Jr., Wilmette, Ill.—1,692,921.

News of the Industry

Control of Government Employees Patents Discussed

CONTROL of inventions or discoveries patented by employees of the government under the present laws was the subject of an important conference by the Directors of Industrial Research meeting in Washington on December 11. This conference was held especially to consider the influence upon industry of recent congressional legislation affecting the rights for commercial exploitation now available to government employees. Speakers at this conference included Thomas E. Robertson, Commissioner of Patents; Karl Fenning, chairman of the National Committee on Patent Legislation; F. S. Holbrook, representing the director of the Bureau of Standards; Colonel J. I. McMullen, patent advisor to the assistant secretary of war; and R. S. McBride, of the staff of *Chem. & Met.*

The congressional act of April 30, 1928, which has changed somewhat the patent situation provides that government employees can procure a patent without fee, giving the government only shop rights, whenever such invention is certified by the head of the department or independent bureau as "used or liable to be used in the public interest." This in effect, the conference was told, gives all commercial rights to patentable results of government research to the individual research man. It was explained that the law was drafted or enacted in part in order to encourage government research by giving the employees the possibility or profit from the patent resulting. Another object sought by the government officials who advocated the law was the insuring of shop rights to the government in all such inventions, and precluding the development of further claims by government employees for royalties on developments made by them in connection with their official duties.

AT THE close of the discussion several of the research executives and corporation patent counsel present stated that they felt that the new law was still more ambiguous in its significance than the old. They based this conclusion upon the fact that those who had studied the act most intimately appeared to differ radically in their opinion as to the circumstances under which the individual inventor might obtain full and exclusive commercial rights to the research results obtained from studies in which he was primarily engaged as a government employee.

A number of the important court cases, including decisions of the Supreme Court of the United States, were cited to show that the government employee is at present regarded by the courts as having the same relation to his employer, the United States government, as does any commercial employee to the corporation which employs him. On this basis it was explained by Mr. Fenning that there should logically be several different classes of cases, depending upon whether the patent resulted from work specifically assigned to the inventor as a part of his official duty, whether it resulted indirectly from this employment but applied directly to his bureau's interests, or whether it lay in some field entirely foreign to his official employment. He cited that in the three cases named there would be three different situations prevailing were the inventor in commercial employment.

RECOGNIZING the serious import of these interpretations, Commissioner Robertson and Mr. Fenning joined in urging that the research executives appoint a committee of investigation to determine whether some remedial legislation, or some modified official policy was required in order to protect the interest of industry. Particularly it was pointed out that industry would, under the present circumstances, perhaps be prevented from full cooperation with the government bureaus. Especially, it was explained by some of the industrial executives present, they could under the present conditions probably not safely make any revelation of their secret information to government men if those men were to be permitted to take private patents on results of investigation which might be the indirect consequence of having access to this confidential information. A number of instances were cited in which this complication had resulted or might have resulted under the present law.

It was also brought out that at the present time there is such a diversity in patent practice between, for example, the Bureau of Standards, the Department of Agriculture, and the War and Navy Departments, that methods which are apparently satisfactory in one case are not adequate for the protection of either the government or the co-operating co-operations in other parts of the government service. There was considerable difference of opinion evident as to whether a uniform practice was feasible, or whether the research bureaus should be regarded as upon one basis, and the bureaus having military or general governmental functions upon another basis.

A.I.Ch.E. Elects Officers for Ensuing Year

THE annual meeting of the American Institute of Chemical Engineers was held at the Chemists Club, New York, on December 3 and December 6. At the evening session on December 3, A. W. Berresford, president of American Engineering Council, gave a description of the work of the council. During the business sessions, the reports of various committees were submitted. This included the report of the committee which canvassed the ballot for the election of officers.

That committee reported the election of the following officers: A. H. White, president; J. C. Olsen, vice-president; H. C. Parmelee, secretary; M. H. Ittner, treasurer; and David Wesson, auditor. Directors elected for three years were: W. L. Badger, C. R. Downs, L. V. Redman, and F. W. Willard.

Shipment of Ammonia from Hopewell Plant

Under date of December 4, a report from Richmond stated that two carloads of liquid ammonia had been shipped from the plant at Hopewell, Va., of the Atmospheric Nitrogen Co., and orders for fifty-seven more cars will be filled shortly.

One of these cars was shipped to the F. S. Royster Guano Co., of Norfolk, and the other had not been routed when the report was given. Production in the first unit of the plant, which has been almost completed, will be gradually increased until the maximum is reached.

Wide Range of Exhibits for Chemical Show

Twelfth Exposition of Chemical Industries Will Open On May 6

THE Twelfth Exposition of Chemical Industries will be held at Grand Central Palace, New York, throughout the week beginning May 6, 1929. The Exposition of Chemical Industries has been a factor in the development of the chemical industries of this country. It brings together among its exhibits between 350 and 450 exhibitors displaying their products, which include the varied types of chemical engineering equipment and processes, and special machinery as used in the various industries. It embraces in this wide range of exhibits products such as apparatus for precise measurement of pressure, volume, flow, temperature, time; laboratory apparatus, supplies, chemicals, etc.; the raw materials used in the chemical industries, the chemicals, dyestuffs, technical materials, and chemical products which are applied in the industries and arts.

THERE will be in the exposition special sections for laboratory equipment, a Southern Section, and a Canadian Section, where in the first case the raw materials suitable for development and manufacture as well as the developed and awaiting development water powers will be shown.

In these special sections the communities located near or at the resources for which financial and industrial development is desired make headquarters, displaying maps graphic charts showing why a factory should be located there to utilize the raw materials they show; railroad companies and State governments are also among these exhibitors and in consequence of these exhibits in years past, have brought to their localities plants which have created big industries and brought other related businesses.

The value of such exhibits both from the standpoint of the equipment maker and the equipment user is more pronounced when it is considered that the chemical process industries more rapidly than most others find it necessary to replace equipment. This is due to obsolescence, chemical corrosion, thermal breakage, and mechanical wear and tear, and a rather general policy has been adopted in the American industries of amortizing the investments in operating equipment in eight to ten years. A conservative estimate was recently made that these industries spend over one hundred and fifty million dollars a year for modernizing and replacements.

Furthermore the steady gain in production of chemicals makes each succeeding exposition more valuable as a meeting ground for displaying the progress which the industry has made. In a study of the chemical industry made during June last, a banking company in New York found that the American Chemical Industry favored by its large domestic market, has grown to be the largest in the world with an annual production of $2,278,000,000. This growth is attributed to the more numerous and prosperous population and the rapid expansion of industries in which chemicals are used. The United States is not independent of the products of other countries and while it is the second largest exporter in the world, it is also the largest importer, and its imports are increasing.

A SECTION for materials handling equipment will give an opportunity to display all improvements in such equipment. In view of the fact that large-scale operations in American industries has been made possible by the greater use of machinery and labor-saving equipment, this section promises to attract wide interest.

The student's course of lectures which has been an institution in the past expositions will be repeated again. These lectures by authorities in their work are divided into two groups; one for elementary students where an extensive knowledge has not been gained and the other an advanced course for senior and graduate students. These courses have been well attended and many colleges give credit to the students for work done which is tabulated and graded at the exposition by Dr. W. T. Read, professor of chemistry from Texas Technological College and a member of the exposition advisory committee who is in charge of the course.

Special consideration has been given to the methods of packing and shipping the products produced by the chemical industries. While some plants make their own peculiar packaging material, the majority purchase from firms who specialize in the manufacture of these commodities. These firms have devoted much research and expense in producing the best variety of container for the products for which they propose them. To give these firms an opportunity to present their products a special section for containers, packaging and shipping equipment was instituted in the exposition some years ago, and at the coming exposition there will be shown such automatic machines as fill bottles, bags, cartons, pails, barrels, etc., and there will be found labeling machinery and all types of container and machines to make or assemble these containers.

CALENDAR

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, convention, New York City, Dec. 27, 1928-Jan. 2, 1929.

AMERICAN SOCIETY FOR STEEL TREATING, semi-annual meeting, Los Angeles, January 14-18.

WESTERN METAL CONGRESS, Los Angeles, Calif., January 14-18.

AMERICAN CERAMIC SOCIETY, 31st annual convention, together with AMERICAN CERAMIC EXPOSITION, Chicago, Feb. 4-9, 1929.

AMERICAN CHEMICAL SOCIETY, 77th meeting, Columbus, Ohio, April 29-May 3, 1929.

TWELFTH EXPOSITION OF CHEMICAL INDUSTRIES, Grand Central Palace, New York, May 6-11, 1929.

AMERICAN ELECTROCHEMICAL SOCIETY, spring meeting, Toronto, May 27-29, 1929.

Naval Stores Corporation in Liquidation

LIQUIDATION of the Naval Stores Export Corporation is being carried out as rapidly as possible. The corporation, which was organized under the Webb-Pomerene act early in 1923, will go out of existence December 31. The business of the corporation will be taken over by the Gillican-Chipley Company, New Orleans, which has handled practically all of the trade for some time.

Stock in the Naval Stores Export Corporation was held by the associated concerns on the basis of their proportionate production. The stockholders were, for the most part, concerns operating in the Southwest and producing turpentine and rosin from wood. Production of wood naval stores in that section has been diminishing for several years and with it have diminished, or disappeared, the holdings of many operators in the export organization. In consequence, the remaining stockholders decided to liquidate the corporation before the opening of another season.

Production of Xylose on a Semi-Commercial Scale

THE Alabama Polytechnic Institute and the University of Alabama, co-operating through the Alabama Industrial Development Board, have arranged to work with the Bureau of Standards in the erection and operation of a small factory in which experiments can be made on the recovery of xylose from cotton-seed bran and peanut shells, on a semi-commercial scale. The plant is now under construction by the Federal Phosphorus Company at Anniston, Alabama. Xylose at present is a rare sugar, selling for about $100.00 per pound, but possessing properties which ought to make it a desirable material for use in the food, textile, and leather industries.

Goodyear Will Build Tire Plant in Alabama

Goodyear Tire and Rubber Company will construct a tire plant at Gasden, Ala., the first unit of which will have a capacity of 5,000 tires per day, according to announcement by Clifton Slusser, vice-president of the company.

The new plant will be the first constructed in the South by any of the major tire manufacturers. The initial unit will employ about 1,800 men.

NEWS FROM WASHINGTON

By Paul Wooton
Washington Correspondent of Chem. & Met.

WHEN THE domestic chemical industry makes its appearance before the committees of Congress at this session it is assured a particularly sympathetic reception. The industry stood before these committees when the 1922 tariff was in the making and asked for enough protection to make it possible to build up a permanent industry.

The legislators realize that the industry has made a great record in volume of production and excellence of product. As the industry grew in strength prices fell correspondingly. With it all there has been no slackening of competition. Practically all products that can be produced in quantity have been cheaper behind the tariff wall than they have been outside of it. It is recognized in Congress that the development of the chemical industry under the act of 1922 constitutes the best example the advocates of the protective policy can offer. The building of a great industry in so short a time unaccompanied by excessive prices is held by some to be one of the principal reasons for the dwindling of the opposition to this form of aid to domestic activities.

An evidence that the industry has done its part is had in the changed attitude of textile manufacturers. There is no evidence that there will be any general opposition to the continuance of the dye schedules, or even to increases covering the special colors which still are produced largely abroad.

OPPOSITION is reaching Washington to the effect that three days is not sufficient time for the hearings on the chemical schedule. The schedule devoted to chemicals, oils and paints is the first one to be taken up. The hearings will be held Jan. 7, 8, and 9 before a sub-committee of the Ways and Means Committee, of which Representative Lindley H. Hadley, of Washington, is chairman. The other members are Representative Aldrich, of Rhode Island, and Representative Faust of Missouri. In this connection it is pointed out that Missouri is the only state representative on the sub-committee which has an important chemical industry. All chemicals on the free list also will come before this same subcommittee during the course of the free list hearings which will be held Feb. 20, 21, and 22.

When the hearings begin the subcommittee will have before it a summary of information prepared at the U. S. Tariff Commission on each important chemical affected. These summaries will give information as to production, uses, prices and the extent of imports and exports. In addition, it is expected that a large number of special memoranda will be prepared acquainting the members of the committee with various phases of the current situation surrounding the items where a change is under consideration. The commission also will submit information on reclassification and competitive conditions surrounding various of the items. On the articles that have been considered under the flexible provisions of the 1922 act there is a large amount of cost data available. There also will be suggestions as to the compensatory duties which will have to be fixed as a result of changes in the rate on the principal commodity.

It is known to be the desire of the committee and of many of the majority leaders to disturb as few rates as possible. On the other hand, the majority members are prepared to recommend higher rates for those chemical products which are meeting severe competition under the existing act. Disodium phosphate is an example. There will be increased demand in the consideration of the next tariff for duties that will stimulate research. In the chemical field, it is suggested, this policy could be applied to pharmaceuticals, to synthetic petroleum products and to synthetic cellulose products.

IT IS expected that determined effort will be made to secure more adequate tariff treatment of the synthetic aliphatic organic compounds. This branch of chemical manufacture has been developed in this country largely since the enactment of the present law and the United States now leads the world in this branch of the business. In fact, the United States occupies a position in aliphatic organic chemistry comparable to that Germany occupied before the war in aromatic chemistry. Developments now under way in the United States indicate a continued expansion and an effort will be made to stimulate this trend by providing duties intended to aid such activities.

Paragraph two of the present act afforded protection to various aliphatic organic compounds, which at that time were laboratory curiosities. Some of these now are being produced on an extensive scale and provide striking examples of the amount of stimulation which an adequate tariff gives an industry. An example of this is had in the manufacture of ethylene glycol. An illustration of one of the difficulties of tariff making is had in providing for a commodity such as cresylic acid. In the present bill cresylic acid of a certain boiling point is dutiable. If the boiling point is lower it comes in duty free.

One of the most active questions which will have to be determined in the revision of the tariff is the basis of valuation of dyes and other coal tar products. In the present act the American selling price is taken as a basis for the assessment of ad valorem duties, if the article is produced in the United States. Although there were administrative complications at first in the handling of this form of valuation, they gradually were ironed out. There is every reason to believe that this policy will be continued for dyes and coal tar products.

COMMERCE reports are to be extended to cover domestic trends and developments of the chemical industry, a service similar to that being carried on as regards foreign countries. It is proposed to gradually expand the scope of this undertaking to include methods and costs of distribution, new uses and byproduct utilization, simplification and standarization, surveys of sources and availability of raw materials, and statistics of stock, production, and consumption by geographical groups and industries within the United States. For this purpose, reorganization has been made within the staff of the Chemical Division, Bureau of Foreign and Domestic Commerce, J. W. Wizeman being placed in charge of the new work. Mr. Wizeman formerly dealt with heavy chemicals and fertilizers which are now handled by H. O. Moraw and E. C. Taylor respectively.

The President under authority of the flexible provisions of the Tariff Act on November 16, issued a proclamation increasing the duty on potassium permanganate by 50 per cent, the maximum increase allowed. The prevailing rate on the commodity is 4c. a lb. The new rate, effective 30 days from the signing of the proclamation will be 6c. a lb. Germany is the chief competing country in the potassium permanganate industry.

THE Bureau of Prohibition has been on a sounder organization and financial basis" in the last fiscal year than ever before, according to the annual report of the Commissioner of Prohibition, Dr. J. M. Doran, which was submitted to the Secretary of the Treasury December 8.

The report stated that each industrial alcohol plant was allotted a fixed quota of the total alcohol to be produced, with a provision that only 40 per cent of their total quota for the year could be produced during the first six months of the calendar year of 1928, provided that legitimate industries did not require an excess of that quantity. This program has been of great benefit to the alcohol industry and the trade by preventing an overproduction of alcohol.

During the fiscal year ended June 30, 1928, there were 308 dealcoholizing plants in operation compared with 342 such plants in operation during the preceding year. There were 128,999,805 gallons of cereal beverages produced during the past year, a decrease of 6,852,567 gallons over the quantity produced during the preceding year.

French Chemical Industry Finds Prospects Favorable

Contract Orders Are Replacing Hand-to-Mouth Buying of Recent Years

From Our Paris Correspondent

A GENERAL OUTLOOK on France's commercial balance reveals that the chemical industry is prospering with prospects favorable for the future. Contract buying in chemicals has increased and the stabilization of the franc has done away with the hand-to-mouth buying which was prominent in recent years.

The iron and steel industries are now showing profits. This is in marked contrast with conditions immediately after the war when the Lorrain steel works were restored to France and the Sarre steel works nearly doubled the French output with no market to take up the increased production.

On the other hand, the textile industry has been moving at a slower pace. Demand for dyes and dyeing materials has fallen off. The Franco-German agreement on coloring matters came to end last August and these may now be imported into France without a special license. An entente was made however between the French and German concerns (the French Kuhmann-Saint Denis group and the German I. G. group) to share the home and foreign markets. The end of the official agreement has, however, brought down the price of several coloring matters such as chromium black which has gone down from 30 Fr. francs to 20 Fr. francs a kilo. The Swiss chemical industry still trades actively on the French market but the Swiss indigo synthetic production has had to slow down. There is a demand for British alzarines and similar products, coloring matters used for the dyeing of acetate silk and rubber, and products used as accelerators for vulcanization. The home industry now supplies all the home needs for permanganate of potassium (about 2,500 qm at 10 Fr. francs a kilo). Bichromates, on the contrary, have to be partially imported, mostly from Great Britain and Germany. Both countries are making strenuous efforts to reconquer this partially lost market.

"LEATHER WEEK" was recently held in Paris with great success and clearly demonstrated the steady progress made since the war. In ten years the consumption of raw hides and leathers has increased by 224,000 qm; exports have also increased, fine leathers and semi-fine leathers by 34 per cent, manufactured leather goods by almost 50 per cent. During the last decade exports in the shoe manufacturing trade have risen from 14,000 qm to 22,800 qm, and it is estimated that the actual total output is about 60 million pairs yearly. In order to supply this big demand the heavy leather tanning industry has been increased considerably. At present its present output is roughly 33 per cent higher than it was in prewar days. In short exports in the leather trade reached a total of 5 billion Fr. francs in 1927 and imports during the same period 3 billion 400.000 Fr. francs.

In the tanning industry chromium salts are frequently used. Chrome leather when worked leaves a large quantity of chips and cuts and research is being made to find a profitable use for them. A new German patent recently taken consists in the treatment of these cuts by boiling water mixed with magnesia, the result giving a clear glue of little viscosity, but so far no serviceable device has been found to recover the chromium salts of these cuts. As most of the chromium salts supplied in France are imported the recovery of chromium has its importance in the home economy.

DURING the World War bromine works had to be built in France, exports being stopped. One of the bromine works was built in the South of France and another in Tunisia. The latter used the waters of salt lakes containing up to 6 kilo. of bromine per cubic meter, producing about 2 tons per day. To day these Tunisian works do not produce bromine industrially as its cost price is too high to be remunerative. They are kept in working order though, but purely for home defence purposes. On the contrary the bromine works built in the South of France near the Berre lake and belonging to the Société Alais Froges Camargue show activity. The mother liquors of salt are used giving a yearly output of 120 tons of bromine but this quantity is insufficient for home needs and in 1926 30 tons of bromine and 27 tons of bromides were imported from Germany. New bromine works have been erected in the vicinity of the potash mines of Alsace. These works use sylvinite i.e. a mixture of chloride of potassium and sodium as extracted from the mining pits. The quantity of bromine contained in these salts depends entirely and varies accordingly on the lay of the mine, but an average 0.1 per cent of bromine may be expected. In order to obtain highly graded chloride of potassium, sylvinite is treated by a boiling hot salt saturated solution in which chloride of potassium dissolves while chloride of sodium, almost as soluble whether heated or not, drops and separates. The latter is then removed and the dissolution left is made to crystallize giving high graded potassium chloride yielding mother liquors containing 3.8 grams of bromine per liter. These mother liquors are treated in the Kubierschky apparatus at a temperature of 75 deg. C. which releases bromine through the action of chlorine leaving only a bromine residue of 0.5 grams. After this treatment the mother liquors are neutralized by an addition of hyposulphite of sodium and caustic soda; they are then used for making new concentrated chloride. About 80 cubic meters of mother liquors may thus be treated daily, yielding about 200 kilos of bromine containing 0.2 per cent of chlorine. As three works now use the aforesaid process it may be said that the daily output is 600 kilos and the yearly output 180 tons. Added to the 120 tons supplied by the Alais Froges Camargue Co. these 180 tons make a total of 300 tons exceeding by about 100 tons the home needs which do not reach 200 tons yearly. We may add that the bromine output of the potassium mines could be notably increased if all mother liquors yielded by the purifying of sylvinite were used but so far this is not the case. Should this be done in the near future however there might be slight competition with the world suppliers of bromine, America and Germany, though these nations' output is considerably larger each of them producing about 1,360 tons yearly.

Plasticity Symposium To Be Held at Lafayette

THE third Plasticity Symposium to be held at the Gayley Chemical and Metallurgical Laboratories of Lafayette College, is scheduled for December 17-18. The symposium will be held under the joint auspices of the Lehigh Valley section of the American Chemical Society and the Research Committee of Lafayette College. Dr. Markus Reiner of the Department of Public Works, Jerusalem, Palestine, will be the guest speaker. Other speakers will include William M. Lewis and Eugene C. Bingham of Lafayette, D. R. Wiggam, Hercules Powder Co., W. P. Davey, Pennsylvania State College, S. E. Sheppard and R. C. Houck, Eastman Kodak Co., E. O. Kraemer and D. V. Gregory, E. I. du Pont de Nemours Co., S. B. Stone, College of the City of New York, and G. S. Haslam and L. B. Grady, Jr., New Jersey Zinc Co.

Butane and Propane Find Wider Markets

BUTANE and propane, petroleum byproducts formerly wasted for lack of a market are now coming into wide use for the enrichment of city gas according to the Secretary of Commerce in his annual report to the President. The report states that one gas plant is using butane alone in the daily production of 1,500,000 cu.ft. of carbureted water gas. Coincident with the work of the Bureau of Mines in this connection, the Bureau of Standards is studying the design of gas burners to be used with butane and propane with a view toward efficiency, capacity, and safety for domestic purposes.

Chemical Engineering Featured in German Expositions

Materials of Construction, Lacquers, Lubricants, and Fuels Given Special Emphasis

From Our Berlin Correspondent

DURING the past Fall technical circles around Berlin were stimulated by several important conventions, especially the International Aeronautic Exposition in October and the International Automotive Exposition in November. To the chemical engineer and metallurgist opportunity was strikingly offered here to see large-scale testimony on their developments which could in the last analysis be termed successful.

In this immediate connection the factors of interest were above all the materials of construction, their protection through the agency of lacquers and other coatings, lubricants and fuels and, indirectly, methods of production control and measurements.

Beginning with the Krupp Works at Essen one notes especially their new high-test steels for bearings and aeronautic construction, and their nitrifying process which produces at once an extreme surface hardness and high malleability in engine steels.

Light metals occupied a conspicuous position in the expositions, as might be expected. From the firm Metallbank, Frankfurt, were to be seen a number of castings of "Silumin," an aluminum alloy containing about 13 per cent of silicon and valued for its light weight, high tenacity, and workability when heated. The metal "Elektron" produced by the I. G. Farbenindustrie has also proved its worth in place of high-grade steels for automotive purposes; it is a very workable and light magnesium alloy. The aluminum alloys of the Vereinigten Leichtmetallwerke, Bonn, known as "Lautal," "Skeleron," and "Construktal" and employed for minimizing dead weight in constructions, are now joined by the new "Alautal." This consists of the first-named light steel with a thin coating of pure aluminum applied to it. Possessing great strength, a low specific gravity (2.75), and high chemical resistance, it is said to retain its aluminum coating firmly, however thinly applied.

NOVEL treatments of wood, especially for aeronautic service, have also attained prominence. The name "Caivet" is used to designate a certain thin pliable birch board treated with casein and which was used in the record flights of Heinkel, Byrd and de Pinedo. Especially interesting is the successful attempt to combine wood with metals. This has been done by the Bisco-Sperrplatten company at Berlin, which coats wood on one or both sides with sheets of copper, aluminum, iron electron, or the other light alloys. The problem of intimately uniting the two elements is solved by cold casein glues, of which a number of durable varieties are manufactured by various firms.

The "Masa"-process, owned jointly by the A.E.G. and the I.G., was recorded here in the October issue (p. 645). At the current expositions the actual commercial application of these products was much in evidence, so that, should economic factors be favorable, a further considerable spread in their use may be expected.

Another product of the A.E.G. is the new "Noratex," manufactured by combining cotton fabric and synthetic phenol-formaldehyde resin. This material, due to its noise-reducing properties, is extensively manufactured into pinions and gears, the other unit in the drive consisting of some very hard metal. The Taroslan Company's "Turbax" belongs to the same class, being used in automotive construction and textile machinery.

LACQUERS for protective coating were in especial evidence. The "Viscoloid" lacquer process (nitrocellulose) of Dr. Albrecht, Mainz, produces a coating which is exceptional for its mechanical resistance. Likewise the nitrocellulose "Glasso" lacquers made by the Glasiturwerke, Hamburg, possess great resistance toward gasoline, benzol, alkaline and soap solutions, and the atmosphere. Among the numerous other products of this class may be mentioned the nitro-lacquer made for the past three years by the I.G.

Although automotive fuels and lubricants are of less concern to American readers than here, the well-known antiknock compound "Motyl" is of some chemical interest. Consisting of ferric carbonyl, $Fe(CO)_5$, it has recently been offered to the public in the form of capsules which can be added to gasoline by the motorist whenever necessary.

Testing and measuring equipment of the most diverse kinds were another incidental feature of these expositions. All in all, it is gratifying to the technologist to view in tangible array such instructive evidence of his successful contributions to major industries.

Nitrate of Soda Research Awards Announced

ANNOUNCEMENT of the Chilean Nitrate of Soda Research Awards for nitrogen investigation was made on November 22 at the annual banquet of the American Society of Agronomy in Washington. Four internationally known scientists, three in the United States and one in Canada, were chosen for the honor. They are: Dr. Jacob G. Lipman, Dean of Agriculture at Rutgers College and Director of the New Jersey Agricultural Experiment Station. Dr. T. L. Lyon, Professor of Soil Technology at Cornell University. Dr. Edwin Broun Fred, Professor of Agricultural Bacteriology at the University of Wisconsin. Dr. Frank Thomas Shutt, Dominion Chemist of Canada.

These men are the first to share in an annual fund of $5,000 which the Chilean Nitrate of Soda Educational Bureau made available one year ago. The agronomy society sponsored the project and the selections were made by a committee of that organization.

Edgar Fahs Smith Memorial Meeting Held

ON TUESDAY, December 4, the University of Pennsylvania held a meeting in memory of Dr. Edgar Fahs Smith. Friends and admirers of the doctor gathered in the Irvine Auditorium. The very fruitful scientific career of Dr. Smith was outlined by Dr. Francis X. Dercum, President of the American Philosophical Society, referring, in particular, to the early days of 1877 and the founding of the Quizmasters' Organization. Colonel M. T. Bogert reviewed the epoch-making researches of Dr. Smith, emphasizing that by far the largest number of investigations and publications were along electrochemical and electro-analytical lines. The final address was by the provost and president of the university, Dr. Josiah Harman Penniman. He commented fittingly on the many outstanding and notable accomplishments by Dr. Smith as a teacher and friend of the student body.

Decline in Production of Lime in 1927

THE Department of Commerce announces that according to data collected at the biennial census of manufactures taken in 1928, the establishments engaged primarily in the production of lime in 1927 reported a total output valued at $41,587,458, a decrease of 18 per cent as compared with $50,736,499 reported for 1925, the last preceding census year. The quantities and values of the principal products for 1927 and 1925, are as follows:

Production of Lime 1925-1927

	1927	1925
Total value	$41,587,458	$50,736,499
Quicklime:		
Tons	2,287,177	2,608,582
value	$20,919,127	$26,310,519
Hydrated lime:		
Tons	1,461,654	1,453,600
Value	$14,055,374	$15,539,371
Agricultural lime:		
Tons	257,395	(1)
Value	$1,247,820	(1)
Limestone sold as such:		
Tons	2,760,958	4,081,828
Value	$3,105,521	$4,809,404
Other products, value 2/	$2,259,616	$4,077,195

1/ Not reported separately.
2/ Road material, lime marl, lime putty, poultry grit, plaster, screenings, etc.

McGraw-Hill Erects Building in Chicago

SIGNALIZING the rapid development of its publishing operations, the McGraw-Hill Publishing Company is having erected for it in Chicago a building to bear its name and for the first time is placing there a resident vice-president as head of its Chicago interests. The building is now in course of erection at 520 North Michigan Avenue, two block north of the Wrigley Building in a rapidly developing new business center and will house all the McGraw-Hill interests centering in Chicago. The resident vice-president will be Edward J. Mehren, a native Chicagoan, who has been with the McGraw-Hill organization in New York for 22 years in editorial and publishing capacities.

These moves are a logical result of the rapid expansion of the company's activities in Chicago. It now publishes there four papers, *"The Magazine of Business," "Factory and Industrial Management," "System,"* and *"Harvard Business Review,"* the latter published for the Harvard University School of Business Administration. A fifth Magazine, *"Industrial Engineering,"* will shortly be transferred from New York to Chicago.

Edward J. Mehren, the resident vice-president, was born in Chicago and educated at the University of Illinois. After a short period of service in the civil engineering corps of the Burlington and St. Paul railroads, he became associate editor of *Engineering Record*, and in succession, editor of that paper, editor of *Engineering News-Record*, vice-president in charge of publication of four of the company's magazines, and, finally, vice-president and editorial director, in charge of editorial work of all its properties. Recently, he was appointed editor of *The Magazine of Business* and will continue that responsibility as well as the resident vice-presidency.

Chemical Analysis Used to Grade Cottonseed

A NEW method of grading cottonseed by chemical analysis has been developed by G. S. Meloy, marketing specialist of the Bureau of Agricultural Economics. The old standard was based on the average value of seed as determined for various producing areas. As oil and protein content may vary as much as 25 to 50 per cent and kernel content from 45 to 65 per cent, need has been felt for a method applicable to separate consignments giving a price incentive to quality production. Oil is the most important factor in price determination. Since the ratio of oil in the kernel is in inverse proportion to that of protein, the problem would be fairly simple if extraction of perfect kernels were possible. Under present conditions, however, it is necessary to work with data obtained from a chemical analysis of the entire seed.

McGraw-Hill Building Under Construction in Chicago

The percentage of oil and of protein is easy to determine. Both respond to the same market stimuli as animal oils, since the protein goes into cattle fodder and the oil competes directly with animal products. Therefore cottonseed oil and protein bear a constant price ratio to each other. On this principle Mr. Meloy has worked out a grading method which is apparently unique. A standard "oil cake reciprocal" is established to represent oil, foreign matter, and ammonia, which last is the protein equivalent, occurring in any combination which will sum up to a standard number. Tables are prepared to show the premium or deduction for each of these three determinants in terms of per cent of the price. Thus it is possible to take the results of an analysis and read of the total deviation from the base price at a glance.

News in Brief

THE DOMINION BUREAU OF STATISTICS at Ottawa reports a production of 66-deg. Bé. sulphuric acid in Canada in 1927 of 98,480 tons, compared with 108,230 tons in 1926. Only six plants in Canada made sulphuric acid in 1927 against eight producers in 1926. These concerns used 19,377 tons of pyrites and 29,805 tons of brimstone, while one made sulphuric acid from waste smelter gases.

THE NATIONAL LEAD COMPANY, through its subsidiary, the National Pigments & Chemical Company, has leased a barytes property at E. Portal, Calif., consisting of about 160 acres. For the development of this property, a new corporation has been formed known as the National Pigments Company, with Evans McCarty as president; A. S. Moses, first vice-president; J. B. Keister, second vice-president, and R. P. Prentys, secretary.

A NEW COMPANY was recently registered in Great Britain under the name of the "Seagoing Factories, Ltd." The company which numbers among its directors the officials of existing fertilizer companies, plans to work the fishing grounds off the west and south African coasts for the production of such fish products as preserved fish, fish meal, fish oils and fish fertilizers by means of factory ships and auxiliary fishing vessels.

A SHORT TIME AGO the first bromine-producing plant in Italy commenced operations. The plant is that of the "Societa Italiana del Broma" of Rome, which extracts bromine from the mother liquors of the largest saltern in Italy—that at Margherita di Savoia. Present daily production of bromine is 80-100 kilogs, but this is to be increased shortly to 130-150 kilogs.

A REPORT FROM CANADA says that an important source of chromite has been discovered west of Armstrong station, Ontario. The deposit is in a dyke about 700 ft. wide and a mile in length. Assays of the ore are said to have shown a chromic acid content of 48 per cent.

THE NEW YORK SECTION of the American Electrochemical Society held its regular fall meeting at the Chemists' Club, November 23. The informal round table discussion was led by J. E. Harris, of the Bell Telephone Laboratories, who described his work on "Thermionically Active Filaments Used in the Telephone Industry." Dr. Harris traced the early work of Edison, Richardson, and De Forest and described the development work that led to the adoption by the telephone industry of filaments covered with coatings of barium and strontium oxides.

A REPORT to THE DEPARTMENT OF COMMERCE states that a British patent has just been issued to E. C. R. Marks of London on behalf of the Chemische Fabrik Stockhausen et Cie., Grefeld, Germany, wherein oils, fats or fatty acids or mixtures thereof are sulphonated in the known manner and after removal of the dilute acid, the resulting product is mixed with water or dilute acids and allowed to stand until no further separation takes place. A neutral or indifferent solvent such as trichloroethylene may be added before, during or after the sulphonation, whereby two layers are obtained, one containing the unattacked or slightly attacked component and the other, sulphuric acid esters.

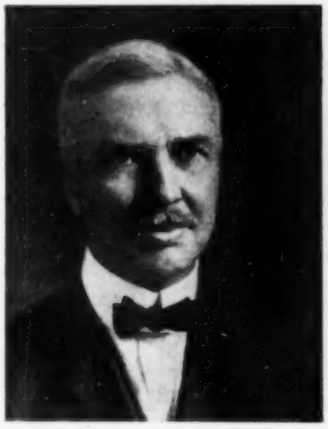
PURCHASE BY THE JOHNS MANVILLE CORPORATION of the assets and entire line of products of the Celite Products Company has been consummated. The Celite Products Company controls a deposit of diatomaceous earth in California.

MEN *in Chemical Engineering*

CHARLES LALOR BURDICK has joined the du Pont organization as director of development for Lazote, Inc., having resigned his position with Guggenheim Brothers, and as vice-president and consulting engineer of the Anglo-Chilean Nitrate Corporation.

CHARLES P. DEVINE has been elected president of the J. P. Devine Manufacturing Company at Buffalo. He was vice-president before the recent death of his father, J. P. Devine, whose position he now assumes.

C. W. SCHOFFSTALL, former Chief of the Bureau of Standards' Textile Section, has become director of the Chicago laboratory of Marshall Field and Company.



A. H. WHITE

A. H. WHITE, professor of chemical engineering at the University of Michigan, was elected president of the American Institute of Chemical Engineers for 1929 at its sessions early this month. He is successor to E. R. Weidlein, director of the Mellon Institute.

H. C. PARMELEE, editorial director of the McGraw-Hill Publishing Company and editor-emeritus of *Chem. & Met.*, has again been elected secretary of the American Institute of Chemical Engineers.

FRANK H. SMITH, of the Lawrence Portland Cement Company, was elected president of the Portland Cement Association at its 26th annual meeting in Chicago late in November.

LUKE H. SPERRY, Superintendent of the Kenvil, N. J., plant of the Hercules Powder Company, has transferred to the Virginia Cellulose Company to become manager of activities at Hopewell.

FRANCIS M. TURNER, JR., is the new president of the Chemical Catalog Company. He succeeds Edward G. Nellis, who died last June and under whom he served as vice-president of the firm. He has been editor in chief of the firm since 1916.

CLAUDE S. HUDSON, who has been named chief of the division of chemistry of the Hygienic Laboratory of the U. S. Public Health Service, was selected to receive the Willard Gibbs gold medal for 1929 by the Chicago section of the American Chemical Society. Dr. Hudson was formerly connected with the Department of Agriculture, but has for the past several years been in charge of certain researches in the carbo-hydroate laboratory of the Bureau of Standards.

L. C. HUGHES, until recently in charge of operation for the Diamond Alkali Company, has been engaged by the American Cyanamid Company for production work at its Linden, N. J., plant. Mr. Hughes did consulting work previous to his position at the Diamond Alkali Company.

W. D. APPEL, dye expert for the Bureau of Standards, is to be head of the reorganized textile section, which will include work in dyestuffs and allied branches now under the chemical division. In his six years with the Bureau Mr. Appel has done much research work for both departments.

GRANT B. SHIPLEY, president of the Century Wood Preserving Company, Pittsburgh, has been appointed a member of the National Committe on Wood Utilization of the Department of Commerce.

HARRY MCCORMACK, who for six years has been consulting chemical engineer for the Brunswick-Balke-Collender Company, will relinquish this connection in January to devote his time to teaching at the Armour Institute of Technology and to his general consulting practice in chemical engineering.

R. M. SANFORD, who has been connected with the Southern Chemical Cotton Company, Chattanooga, Tenn., has left this firm and will take up new duties early in the coming year.

RALPH T. GOODWIN

RALPH T. GOODWIN, chemical engineer in the development department of the Standard Oil Company at Bayway, N. J., has resigned to become the head of a newly formed petroleum division of the sales department of the Dorr Company. Dr. Goodwin's well-known process will be marketed jointly by both companies.

HENRY E. STOCKFISCH, until recently development engineer at Thomas A. Edison Industries, Orange, N. J., has resigned to accept a position as development engineer with Westinghouse Electric and Manufacturing Company, at East Pittsburgh, Pa.

OBITUARY

GEORGE H. JONES, chairman of the board of the Standard Oil Company of N. J., died in New York on November 22nd after a protracted illness and several operations. Mr. Jones' career was the story of a remarkable rise from almost hopeless hardship, overcome entirely by his native talents and aggressiveness.

VICTOR B. FAULKNER, chemical engineer with the National Aniline & Chemical Company at Buffalo, died on November 15 at his home in that city. Connected with his firm since 1919, Mr. Faulkner was only 38 years old at the time of his death and had won himself an enviable technical reputation.

SABIN VON SOCHOCKY, a native of Austria and inventor of luminous radium paint, died on November 14, a victim of his own invention. He was consulting expert for the U. S. Radium Corporation, Orange, N. J., and was said to have received the poison by inhalation. He had already been seriously ill for more than a year at the time of his death.

S. J. JENNINGS, vice-president of the United States Smelting, Refining and Mining Company, died of heart attack at his home in New York on November 19 at the age of 65. He was educated at Harvard, Tours and Hannover, and was at one time one of the leading engineers in South Africa.

JOHN K. HAYWOOD, chemist in charge of insecticide and fungicide supervision for the Federal Food, Drug and Insecticide Administration, died on November 30 in Washington at the age of 54. Dr. Haywood was a graduate from Cornell and soon joined the U. S. Department of Agriculture in 1897.

GEORGE I. KEMMERER, associate professor of chemistry at the University of Wisconsin, died on November 18 in his 50th year.

MARKET CONDITIONS *and* PRICE TRENDS

Domestic Production of Soap Shows Upward Trend

Output in 1927 Exceeded Totals Reported for Preceding Census Year

ACCORDING to data collected at the biennial census of manufactures taken in 1928, the establishments engaged primarily in the manufacture of soap in 1927, including the soap departments of large slaughtering and meat-packing establishments, reported products valued at $287,059,935, of which amount $241,929,510 was contributed by soap and $43,130,425 by other products, such as glycerin, perfumery, toilet preparations, etc. The total production shows an increase of 3.2 per cent in value as compared with $278,273,107 for 1925, the last preceding census year.

The items which make up the total of $241,929,510 for soap made in 1927 are as follows: Hard soaps, 2,371,645,874 lb., valued at $207,297,961; soap powder, 497,569,236 lb., valued at $25,711,513; special soap articles, valued at $2,432,461; liquid, paste, and soft soaps and soap stock or soap base, valued at $6,487,575.

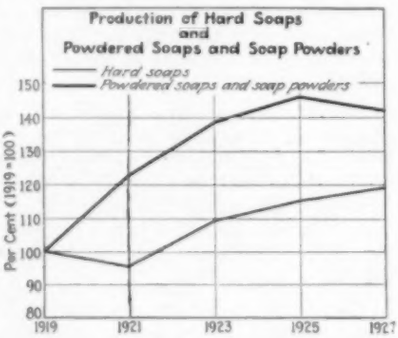
This industry title covers establishments engaged primarily in the manufacture of soap and soap products, consisting chiefly of hard, powdered, soft, paste, and liquid soaps, and special soap articles.

The statistics for 1927 and 1925 are presented in the following tables. The figures for 1927 are preliminary and subject to such correction as may be found necessary after further examination of the returns.

AN analysis of production figures for the different kinds of soap establishes that the output of some grades has been increasing while other grades have been turned out in diminishing volume. The general grouping of hard soaps has varied somewhat in recent census returns. Prior to 1925, the totals reported under that heading did not include granulated or powdered soap whereas the latter has been included in the hard soap grouping in the returns for 1925 and 1927. According to these returns the output of hard soap was 2,371,645,874 lb. in 1927 and 2,251,455,045 lb. in 1925 or a gain of 5.3 per cent for the period.

Breaking down hard soaps into its subdivisions a gain in volume of about one-third is reported for 1927 as compared with 1925. Soap chips also were produced in larger quantities and the same holds true for granulated and powdered soap. Laundry soap, however, has failed to keep pace with progress shown by the soap industry as a whole and a decided falling off in output is found between 1925 and 1927.

Unfavorable balances for 1927 also are found in the divisions of soap powders, cleaners, cleansing powders, etc., liquid, soft and paste soaps. The decline in production of these soaps is accounted for on the ground of shifting consuming demand with a growing preference for powdered soap and soap chips.



In the accompanying graph, production totals for granulated and powdered soap are included with those for soap powders for the sake of comparison with earlier years when such listing was followed by the census figures.

AN interesting feature of the census report consists in the statement that the average number of wage earners declined from 15,406 in 1925 to 13,432 in 1927. This is regarded as evidence of the greater mechanization of plants resulting in a larger output per worker.

The cost of materials and supplies likewise has been of a declining nature while the value of finished products was enhanced by more than 3 per cent.

Foreign trade in soap has not made much progress in recent years. Export shipments of toilet soap in 1926 and 1927 were larger than those for the preceding years but outgoing quantities of laundry soap were smaller than the totals as reported for 1922 and 1923. Exports of other grades of soap also declined in 1927 and the total outward shipments for all grades of soap in that year were 77,407,675 lb. as compared with 83,366,581 lb. in 1926 and 88,819,507 lb. in 1922. The declining tendency of export trade in soap continued into the present year as shipments for the first nine months of 1928 were 45,169,766 lb. as compared with 58,493,635 lb. in the corresponding period of 1927.

Importations of soap in the last half dozen years have not varied enough in volume to show any decided trend.

Summary for the Soap Industry, 1927 and 1925

	1927	1925
Number of establishments	256	272
Wage earners	13,432	15,406
Wages	$19,715,931	$18,526,104
Cost of materials, factory supplies, containers for products, fuel, and purchased power, total.	$172,244,130	$184,873,537
Materials, supplies, and containers	$168,065,295	*
Fuel and power	$4,178,835	*
Value of products	$287,059,935	$278,273,107
Value added by manufacture	$114,815,805	$93,399,570
Horsepower	62,025	56,687

*Not reported separately.

Export of Soap

	Toilet, Lb.	Laundry, Lb.	Other, Lb.
1927	8,185,746	56,230,035	12,991,894
1926	8,974,695	60,766,610	13,625,276
1925	6,749,339	55,784,860	13,098,254
1924	5,376,453	54,276,016	17,724,053
1923	7,369,539	66,498,491	18,456,371
1922	7,565,881	67,079,838	14,173,788

Imports of Soap

	Castile, Lb.	Toilet, Lb.	Other, Lb.
1927	2,395,500	1,652,516	1,921,427
1926	2,021,096	1,219,148	3,099,924
1925	1,823,541	1,088,716	2,579,652
1924	1,740,562	908,514	1,944,624
1923	1,861,576	903,314	2,572,248
1922	2,703,888	1,123,670	2,202,398

Production of Hard Soaps

	Lb.	Per Cent of 1919
1919	1,836,003,000	100
1921	1,752,136,800	95.4
1923	2,000,340,573	108.9
1925	2,109,133,309	114.9
1927	2,197,715,591	119

Production of Powdered Soap and Soap Powders

	Lb.	Per Cent of 1919
1919	472,610,000	100
1921	580,371,000	122.8
1923	655,060,628	138.6
1925	690,307,866	146
1927	671,499,519	142

Domestic Production of Soap By Grades—Census Years 1919-1927

	Toilet, Lb.	Chips, Lb.	Laundry, Lb.	Powdered and Soap Powders, Lb.	Liquid, Lb.	Soft, Lb.	Paste, Lb.
1927	444,149,581	372,261,067	1,324,354,727	671,499,519	14,453,652	43,269,014	20,670,473
1925	332,934,996	325,042,787	1,370,228,721	690,307,866	22,047,417	61,189,483	30,086,050
1923	240,144,347	218,754,320	1,516,282,230	656,060,628	17,879,054	67,751,705	40,584,253
1921	197,274,000	144,536,000	1,305,709,000	580,371,000	10,529,000	63,275,000	19,631,000
1919	179,350,000	181,837,000	1,347,840,000	472,610,000	10,033,000	64,463,000	.....

MARKET APPRAISAL OF CHEMICAL INDUSTRY

Air Reduction Co. declared regular quarterly dividend of 50 cents, payable January 15 to stock of record December 31.

U. S. Rubber Co. is offering common stockholders of record December 21 right to subscribe to additional common at $35 in ratio of one share to each share held. Rights expire January 11.

Devoe & Raynolds Co., Inc., declared extra dividends of 15 cents each on no-par A and B common in addition to the regular quarterly dividends of 60 cents each. Regular quarterly dividends of $1.75 each were also declared on the first and second preferred stocks. All dividends are payable January 2 to stock of record December 21.

The Newport Co., Milwaukee, manufacturers of dyes and chemicals, has announced a plan of recapitalization and that $6,500,000 of stock will be offered to the public. Part of the new capital will be used in expanding the company as it has acquired the Acme Products Co., De Quincy, La., operating a wood distillate plant, and it has gained control of the General Naval Stores Co., a selling organization through which both Newport and Acme Products have been marketing their wood distillates.

Liquid Carbonic Corp. has purchased a substantial interest in the business of Dry Ice Corp. of America. Liquid Carbonic directors also have authorized a ten-year contract with Dry Ice for the production and sale to it of carbonic gas, at such points as may be found to be economical and advantageous. Dry Ice proposes to build plants conecting with the plants of Liquid Carbonic at its 16 branches as rapidly as the market develops.

Published profits of seven chemical companies for the nine months ended Sept. 30 show a combined increase of 16.01 per cent, compared with the corresponding period last year. The companies are Air Reduction, Columbian Carbon, Commercial Solvents, Hercules Powder, Mathieson Alkali, National Distillers Products and Union Carbide and Carbon.

Net profits for the first nine months of 1928 and 1927, as compiled by Ernst & Ernst, accountants, follow:

	1928	1927
Air Reduction Co., Inc.	$2,528,166	$2,004,211
Columbian Car Co.	2,105,851	1,511,991
Commercial Sol., Corp.	2,099,774	1,651,503
Hercules Powder Co.	2,820,112	2,376,366
Math'son Alk. W., Inc.	1,560,020	1,378,362
Nat. Dist. Prod. Corp.	311,218	174,707
Union C. & C. Corp.	19,629,483	17,672,806
Total	$31,054,624	$26,769,946

Price Range Jan 1–Dec. 11 High	Low	Stock	Price Range in November Nov. 1	High	Low	Nov. 30
90¼	59	Air Reduction	79¼	87	79¼	84½
14⅜	7½	Ajax Rubber Co.	8½	11	8½	10½
252½	146	Allied Chemical	225½	252½	224½	241½
125½	120½	Allied Chemical, pf.	122½	125	122	123
26	15½	Am. Ag. Chemical	18½	26	18½	22⅜
79½	55½	Am. Ag. Chemical, pf.	66½	79½	66½	74½
53⅜	30½	American Cyanamid, B	38⅜	53½	37⅜	50⅜
15⅜	8½	Am. Hide & Leather	9	9½	8½	9½
170	56⅜	American Linseed	126½	170	125½	170
181	86½	American Linseed, pf.	140	181	136	181
66¾	39	American Metal	49⅜	66¾	49⅜	59
24	13	Am. Rayon Products	17½	21½	17	20½
28¼	11⅜	Am. Solvents & Chemical	19⅜	26⅜	19	26⅜
54	26½	Anglo-Chile Nitrate	31	37½	30	35
112⅜	55½	Archer-Daniels-Midland	94½	112⅜	93½	103½
33⅜	26½	Ass. Dyeing & Printing	31½	32⅜	28⅜	28⅜
109¾	63	Atlas Powder	81	95	80½	93
24½	12½	Beacon Oil	20⅞	22½	20½	21⅜
92	70⅜	Beechnut Packing	78⅜	88½	76½	85½
80	65½	Bon Ami, A.	73⅜	80	72⅜	78½
97¼	65	Bristol-Myers	81⅜	97¼	81⅜	94
36	24	Calif. Petroleum	35	....	....	....
103	41	Celanese Corp.	59½	63½	41	44½
112	95	Celanese Corp., pf.	....	100	95	97
63½	28½	Certainteed	31¼	32⅜	29½	29½
56½	45	Chickasha Cotton Oil	50	51	48½	50⅜
250½	137½	Commercial Solvents	214½	250½	212	238⅜
94	64⅜	Corn Products	84⅜	94	83½	92⅜
68⅜	34⅜	Davison Chemical	59	68½	57½	64⅜
61	40	Devoe & Raynolds	51⅜	59⅜	51	56½
120	108	Devoe & Raynolds, pf.	113	115	112	....
503	310	Du Pont	430	503	430	492
121½	114	Du Pont, 6 pc. db.	118½	119	118	118½
194½	163	Eastman Kodak	180	193	179½	186
238	165	Firestone Tire	171	198	171	198
17⅜	8¼	Fisk Rubber	11½	15½	11½	14⅜
89½	65	Fleischmann	80	87½	79½	84
109½	43	Freeport Texas	46½	49½	45½	47½
36⅜	20¾	Glidden	27⅜	36⅜	27½	34⅜
105	95	Glidden, pf.	103½	104½	103½	104½
142	71	Gold Dust	103	137½	101½	135½
99⅜	68½	Goodrich Co.	78½	89	78	86
167	118⅜	Houston Oil	134	139	131	131
146	122½	Industrial Rayon	....	142	132	132½
20⅜	13	Int. Ag. Chemical	14	17½	14	16½
84½	48⅜	Int. Ag. Chemical, pf.	78½	84½	77½	82½
86⅜	50	International Paper	53½	61⅜	53½	57
69	49½	International Salt	55	59	52	57½
25½	19⅜	Kelley-Sprinfield	21½	25½	19⅜	24½
26½	17⅜	Lee Rubber & Tire	21½	23⅜	19½	21⅜
64½	38	Lehn & Fink	56⅜	62½	55⅜	61
186	109	Libby-Owens	173	186	163½	167
124½	63½	Liquid Carbonic	78⅜	124½	77½	119½
190	117½	Mathieson Alkali	160	173	158⅜	168
....	....	Monsanto Chemical	....	95	93	....
58½	29½	Nat'l Dist. Products	37⅜	42⅜	35½	41½
136	115	National Lead	117	134½	117	129
260	180⅜	New Jersey Zinc	229½	243	227½	240
83½	58½	Ohio Oil	63⅜	83½	63⅜	80½
95⅜	74½	Owens Bottle	83	91⅜	83	88
....	....	Palmolive Peet	....	....	....	....
53⅜	35½	Phillips Petroleum	44⅜	53½	44	50⅜
300	210	Pittsburgh Plate Glass	285	290	263	....
....	....	Pratt & Lambert	62	72½	62	70½
31⅜	19	Pure Oil	26½	31½	26½	28⅜
....	....	Sherwin-Williams	....	92	89	....
29	17	Silica-Gel	21½	26⅜	19	25½
46½	17⅜	Sinclair Oil	37½	46½	37½	45½
42⅜	25	Skelly Oil	36⅜	42⅜	36⅜	40
80	53	Standard Oil, Cal.	61½	80	61½	75⅜
59⅜	37½	Standard Oil, N. J.	47⅜	59½	47	59⅜
42½	28⅜	Standard Oil, N. Y.	35⅜	41½	35½	41
7⅜	2½	Standard Plate Glass	4½	5½	4	4⅜
77	31½	Sun Oil	62	77	61½	76
....	....	Swan & Finch	....	22½	21½	21⅜
19½	10½	Tenn. Copper & Chemical	16½	18⅜	16½	17⅜
74⅜	50	Texas Corp.	67⅜	74½	67½	68⅜
82½	62½	Texas Gulf Sulphur	69½	82½	69½	76⅜
25	14½	Tidewater Oil Ass.	21½	24½	21½	23½
630	450	Tubize Silk	576	580	515	545
209	136½	Union Carbide	190	209	188	200½
58	42½	Union Oil, Cal.	51⅜	58	51½	55
120	52½	United Piece Dye	....	120	82	111
138	102½	U. S. Ind. Alcohol	129½	132	123	131⅜
51	22	U. S. Leather	33½	35½	30⅜	32⅜
63½	27	U. S. Rubber	38⅜	43⅜	37½	41½
101½	72	Vacuum Oil	84⅜	101½	84½	97½
111½	60	Vanadium Corp.	85⅜	111½	81	102⅜
78⅜	58	Vick Chemical	72½	78½	72	77½
20⅜	12	Va.-Ca. Chemical	13⅜	20½	13⅜	19½
64½	44⅜	Va.-Ca. Chemical, pf.	52	64½	52	61
110	87	Wesson Oil	....	98⅜	87	98
16	11	Wilson & Co.	11½	13⅜	11	12⅜

ECONOMIC INFLUENCES *on production and consumption of* CHEMICALS

Production of Chemicals Maintained on Active Scale

Consuming Industries Absorb Larger Quantities Than in Corresponding Period Last Year

WHILE there is a tendency on the part of consuming industries to restrict buying as the end of the year approaches so as to keep down inventories, conditions in general reflect larger scale operations than was the case a year ago. Steel operations declined about 5 per cent in November but were above the seasonal average. The automotive industry also showed a recession in November as compared with preceding months but was more active than in November, 1927. Production of chemicals followed the general trend but offers a decidedly favorable comparison with the corresponding period of last year not only in the movement from producing centers but also in the volume of forward business which has been placed.

Recent figures show that production of wood distillation chemicals has been speeded up. For some months the output was below the level of consuming needs and reserve stocks were drawn upon to fill orders. At the end of January, stocks of acetate of lime were reported at 17,596,333 lb. and at the close of October they had been reduced to 3,120,711 lb. Stocks in Canada at the close of October were down to 348,776 lb. A similar situation existed in the case of crude methanol. At the close of January, the reserve supply was 1,126,152 gal. which had dwindled to 161,723 gal. by the end of October.

THE most recently available figures reflecting on productive activities in the chemical and chemical-consuming industries are for October and the accompanying table offers a basis for comparison of productive activities in that month with the preceding month and with October of last year.

Productive Activities in Chemical and Related Industries

		1928		1927
		September	October	October
Acetate of Lime	Lb.	8,235,004	9,956,891	13,848,820
Methanol, crude	Gal.	452,750	591,369	692,299
Methanol, refined	Gal.	355,353	487,384	688,435
Sulphuric acid, by superphosphate manufacturers	Ton	173,565	198,973	.....
Byproduct coke	Ton	3,958,682	4,219,262	3,720,262
Chemical wood pulp	Ton	201,646	228,434	213,472
Petroleum refining run of stills	Bbl.	79,810,000	79,603,000	71,761,000
Ethyl alcohol	Gal.	18,613,000	20,685,000	16,584,000
Cottonseed oil, crude	Lb.	126,584,000	280,383,000	268,966,000
Cottonseed oil, refined	Lb.	61,889,000	204,255,000	194,676,000
Automobiles, passenger cars	No.	358,872	341,705	183,042
Automobiles, trucks	No.	56,411	57,113	36,640
Glass containers	Gross	2,322,000	2,389,000	1,969,000
Wool, consumed in textile mills grease equivalent	Lb.	43,492,000	51,477,000	49,122,000

Analysis of the above figures reveals a favorable condition in the byproduct coke industry and presages a larger supply of raw materials for conversion into dyes and coal-tar chemicals. Production of chemical wood pulp not only showed a substantial gain over September but was more than 13 per cent higher than in October, 1927. Petroleum refining, as measured by the run of stills, while falling off somewhat from the preceding month was nearly 11 per cent above the rate maintained in October, last year. The automotive industry has experienced a moderate slackening in activity but offers a very favorable comparison with the corresponding period of last year. Textile mills report a gain over last year in consumption of wool and the glass trade has maintained its increase in output.

INDUSTRIAL production during October, according to the weighted index of the Federal Reserve Board, after adjustments for seasonal variations, remained unchanged from the previous month, each being higher than at any other time on record. The principal gains over a year ago occurred in the output of automobiles, rubber tires, iron and steel, and cement, brick and glass, while a decline from last year was registered in the output of textiles, lumber and leather. Mineral production, after adjustment for seasonal conditions, showed gains over both the previous month and October of last year, the principal increase over last year occurring in copper.

Stocks of commodities held at the end of October were higher than at the end of the previous month, but showed a decline from a year ago, due to a decrease in stocks of manufactured goods. Contrasted with the preceding month, stocks of manufactured goods were smaller, while raw materials were larger.

The general index of unfilled orders was slightly lower than for the previous month and October of last year. Compared with September, unfilled orders for textiles and transportation equipment were larger but forward business on the books of lumber mills declined. As compared with a year ago, iron and steel and lumber showed larger unfilled orders, while textiles declined.

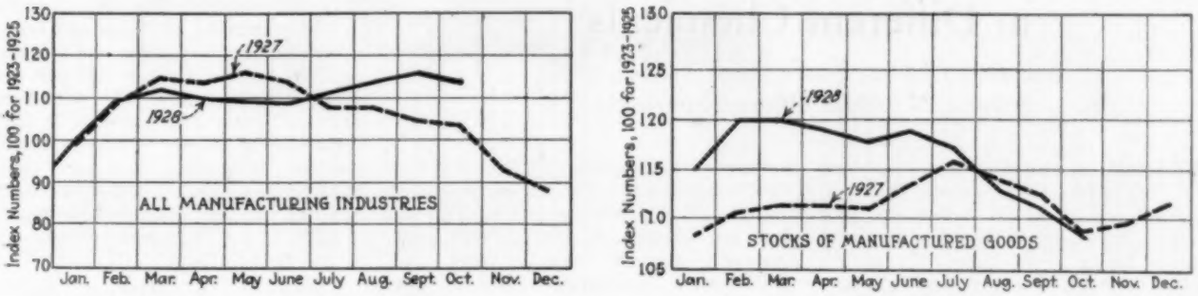
CLOSING its fiscal year on September 30, the linseed oil industry reported that consumption had been the largest in the history of the trade. Recent demand for oil has shown a seasonal decline but it has been demonstrated that the growing use for lacquers has not adversely affected the outlets for oil and with building operations promising to hold up the outlook for linseed oil is encouraging. Consumption of refined cottonseed oil for the first three months of the new fiscal year, beginning August 1 amounted to 1,003,416 bbl. which compares with 997,040 bbl. in the corresponding quarter of 1927. While the movement of cottonseed oil is partially governed by competitive conditions, the soundness of the market is illustrated by the fact that there is a natural annual increment in consuming demand for oil and the seed supply for this year's crush is smaller than it was for the year which closed on July 31.

BECAUSE it is the largest consumer of sulphuric acid and, in addition, absorbs large quantities of potash salts, nitrates, and other chemicals, conditions in the fertilizer trade are of interest because of the effect they have on the chemical industry as a whole. Sales of fertilizer tags in southern states for the first four months of the fertilizer year—August-December—were 3.2 per cent smaller than for the corresponding period of last year. Production of superphosphates also has shown an unfavorable comparison for the period. The future position of the cotton and grain markets will have much to do with shaping the market for fertilizers and with signs pointing to an active first quarter in the coming year for business in general, it is probable that this condition will be reflected to some extent in the fertilizer industry.

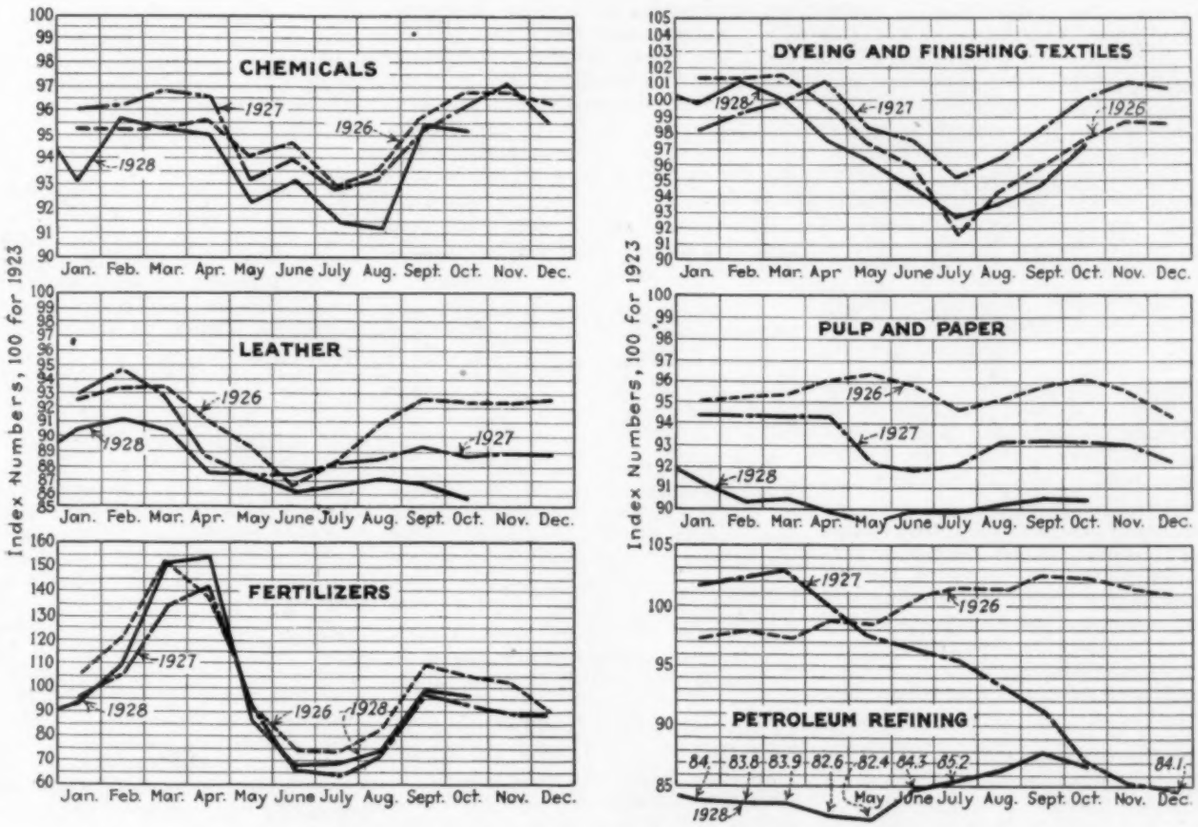
Export trade in chemicals has maintained an increase over that of a year ago and in October, shipments to outside markets were valued at $11,733,697 as against $9,988,466 in October, 1927. In the industrial chemical group, October exports showed a gain of nearly $33,000 over the October, 1927 total.

Imports of chemicals in October were valued at $11,765,311 as compared with $12,313,715 for October, last year.

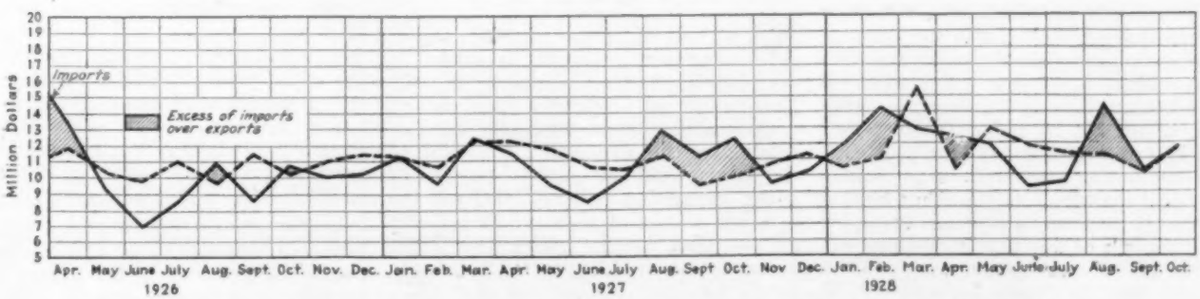
INDEXES OF ACTIVITY IN PRODUCING AND CONSUMING INDUSTRIES



VOLUME OF PRODUCTION *(U. S. Dept. of Commerce)*



FACTORY EMPLOYMENT *(U. S. Dept. of Labor)*


Million Dollars
Imports
Excess of imports over exports
Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept Oct. Nov Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct.
1926
1927
1928

FOREIGN TRADE IN CHEMICALS AND ALLIED PRODUCTS

MARKET CONDITIONS *and* PRICE TRENDS

Limited Stocks Affect Spot Trading in Different Chemicals

Acetate of Lime, Acetic Acid, Toluol, and Solvent Naphtha Offered Sparingly

WHILE contract orders for various chemicals have been placed in large volume in recent weeks, the spot market for many selections has been featured by a small supply in sellers hands. Wood distillation chemicals during the year were gradually working to a point where surplus holdings were called upon to take care of the discrepancy between production and consumption. As these surplus stocks reached a vanishing point, there was an attempt to speed up production but earlier reports predicted a preponderance of demand over supply for the final quarter of the year and these reports have been verified. The rayon industry has been drawing heavily upon acetic acid and with a large part of production absorbed by contract commitments, the spot supply has not been adequate to fill consuming needs. Acid manufacture, in turn, was held in check by the restricted operations of producers of acetate of lime. Acetone and formaldehyde, likewise, have been firmly held as a result of lessened outputs. The situation now is showing improvement as production is progressing along broader lines and offerings for the first quarter of next year promise to be larger.

IN THE contract field, the volume of business placed compares very favorably with that reported for the corresponding period of last year. In many cases—and these include such important chemicals as soda ash and caustic soda—the contracting movement has been larger than was the case a year ago.

During the last month interest in white sal ammoniac was heightened by the announcement that leading producers were willing to book orders for 1929 delivery at 4.60c. per lb. This is the lowest price at which this chemical has been quoted in the history of the trade and reflects not only a reduction in producing costs but also the effect of competition between domestic and foreign sellers. Last year prices were reduced to a relatively low level in a successful attempt to reduce importations and it is evident that domestic producers are continuing their efforts to control the local market. On the other hand a review of Germany's chemical trade for the first half of this year shows that exports of sal ammoniac were 13,448 metric tons as compared with 12,737 metric tons for the first half of 1927. Exports of sal ammoniac from Great Britain in 1927 amounted to 4,693 tons which represented a material gain over the totals for preceding years. For the first ten months of the current year, however, British exports were only 3,623 tons as compared with 3,853 tons for the corresponding period of 1927.

THE position of potash salts has been clarified by an announcement from the distributors of foreign producers. This announcement stated that production at the Franco-German potash mines has been so geared up during recent months that, although America is consuming potash in increasing volume, there will be no increases in prices during the current price year, which ends next April 30, 1929.

The prices which are guaranteed against a decline up to the end of next April are as follows:

	In Bags	In Bulk
Muriate of potash	$36.40	$34.80
Sulphate of potash	47.30	45.70
Sulphate of potash-magnesia	27.25	25.65
Manure salts	21.75	18.75
Manure salts (20% K_2O)	15.40	12.40
Kainit (14% K_2O)	12.50	9.50
Kainit (12.4% K_2O)	12.00	9.00

The sellers stated that they anticipate a considerable increase in the tonnage of potash used by fertilizer manufacturers and farmers next year. In order that a shortage of potash may not be created by this increasing demand, which would result in violent upward price fluctuations, they have made further efforts toward stabilizing the market by increasing the output of their mines abroad.

They also pointed out that during the entire period of 1914-1927 the United States used 2,131,643 tons of potash. In 1919 the consumption was 73,778 tons and in 1920 it rose considerably, after which year there was a regular yearly increase that brought consumption to 290,000 tons in 1927.

MATERIAL gains in the export movement of borax as shown in the official figures compiled by the Department of Commerce have caused considerable interest regarding the disposition of this material. According to the latest available figures exports of borax amounting to $3,227,000 for the first ten months of 1928 are 33 per cent greater than for the entire year 1927. Estimates on the full year 1928 indicate nearly a 60 per cent increase over 1927.

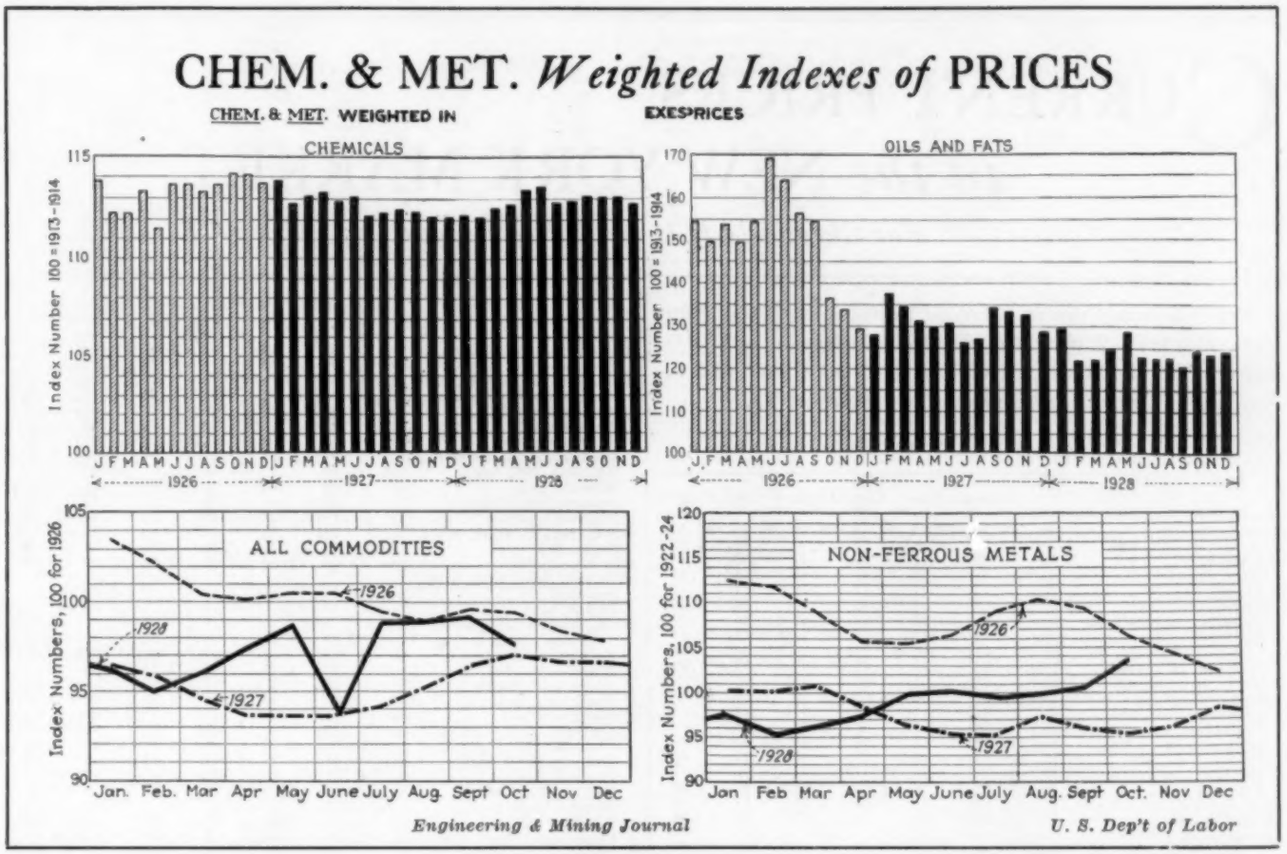
Europe and the Far East are the largest consumers of American borax, the North Central American and West Indies section ranks third, with South America fourth. The largest increases in the purchases of American borax by individual countries for the ten months of 1928, are in France 220 per cent to $490,482, Germany 81 per cent to $730,007, Italy 142 per cent to $87,057, Netherlands 9 per cent to $313,301, United Kingdom 12 per cent to $983,152, China 1,250 per cent to $29,142, Hong Kong 400 per cent to $7,977, the Philippines 30 per cent to $7,287 to $47,740.

Those of the principal consumers whose purchases are less for the ten months of 1928 than for the entire year 1927 are Canada, Brazil, Colombia and Japan. However, the estimated total for this group for the entire year 1928 is about equal to 1927 sales. Of particular note in the South American group is the increase in Bolivia from $17 in 1927 to $7,350 for ten months of 1928.

TRADING in coal-tar products has been checked somewhat by the small supply of certain selections. Buyers have had difficulty in securing prompt shipment of such materials as benzol, solvent naphtha, toluol, and xylene. Producers of these chemicals have been well sold ahead for some time and with very little surplus stocks on hand, prices for spot material and for December shipment are little better than nominal. Inquiry for round lots of toluol have brought out asking prices of 50c. per gal. and even higher figures, although the contract quotation is quoted as unchanged at 40c. per gal. In connection with possible increases in production of toluol it is held that a sustained higher price level for refined products would encourage recovery of toluol from crude light oils in larger volume than has been the case in the past. It, also, is pointed out that processes have been developed, some of them patented—whereby it is possible to increase substantially the yield of toluol from a given coke oven without increasing the quantity of coal processed.

A development of importance in the market for ammonia was found in the announcement that two carloads of liquid ammonia had been shipped from a southern plant, this representing the initial production of an atmospheric nitrogen plant at Hopewell, Va. Having a new producer into the market has had no effect on quotations and producers are reported to have sold a good part of production for the coming year.

Under date of Nov. 16, the President issued a proclamation, authorizing a rise of 50 per cent in the import duty on potassium permanganate. This action has not yet had any market influence.


CHEM. & MET. Weighted Indexes of PRICES
CHEM. & MET. WEIGHTED IN EXES PRICES
CHEMICALS
OILS AND FATS
Index Number 100 = 1913-1914
Index Number 100 = 1913-1914
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1926
1927
1928
ALL COMMODITIES
NON-FERROUS METALS
Index Numbers, 100 for 1926
Index Numbers, 100 for 1922-24
1926
1928
1927
Jan. Feb. Mar Apr May June July Aug. Sept Oct Nov Dec
Engineering & Mining Journal
U. S. Dep't of Labor

Steady Price Tone Underlies Trading in Chemical Products

WITH contract prices for chemicals, covering deliveries over next year, well established and with a good part of the domestic output sold ahead, the market shows a steady price tone which is expected to continue throughout the first quarter of the year. The spot market, due to inadequate supplies, has developed price uncertainties in the case of certain selections.

The scarcity of offerings of toluol for prompt shipment has made it impossible to establish any definite spot quotation and sales are reported to have been made at varying price levels with 50-55c. per gal. apparently representing sellers' views. Solvent naphtha and xylol are in a position similar to that reported for toluol. Benzol also is well sold ahead and the small surplus stocks are in firm hands. To remedy this situation it will be necessary to break up light oils in larger volume and there are indications that this is being done.

Attention has been called in recent months to the fact that the output of wood distillation chemicals was running behind consuming standards. Latest reports verify the statement that production has been increased and the situation promises to work more in buyers' favor.

ANNOUNCEMENT has been made to the effect that, prior to April 1, 1929, no changes will be made in existing price schedules for muriate of potash, sulphate of potash, and other natural potash salts produced in Germany and France. Permanganate of potash, however, has been placed in a position of advantage through an increase in import duty from 4c. per lb. to 6c. per lb. It is not probable that quotations will reflect the full advance of 2c. per lb. in the duty as this would encourage competition from foreign producers. The higher duty, however, will become a price factor as soon as stocks of imported material held here become depleted, and it is logical to anticipate a rise of possibly 1c. per lb. in asking prices for the domestic product. Chlorate of potash may be included among the potash products for which higher prices will rule during the coming year. The market has been under the control of imported chlorate for some time and opposition from domestic offerings which has been gradually diminishing may become altogether negligible.

WHILE the position of refined cottonseed oil did not change materially during the month, the crude market was higher and this had much to do with bringing about a higher weighted index number. Consumption of refined oil has been along generous lines and prices for the next few months will be influenced to considerable extent by the volume of consuming trade.

Taking the last fiscal year as a basis, annual requirements of linseed oil are running around 100,000,000 gal. This will necessitate larger importations of flaxseed and places more dependence on the present Argentine crop. It is also pointed out that cake prices have been high, thus lowering production cost for oil; and cake prices may be expected to decline before the end of the first quarter of next year and thus reflect adversely on prices for oil.

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This month	**112.83**
Last month	113.08
December, 1927	112.08
December, 1926	113.71

Nominal prices were quoted for toluol, solvent naphtha, and xylene in the spot market but sales were at higher levels. Boric acid was offered at lower levels with steady values for mineral acids and most heavy chemicals. Decline in basic carbonate of lead had most effect in lowering the weighted index number.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1913-14

This month	**124.16**
Last month	123.60
December, 1927	128.30
December, 1926	128.94

Under the leadership of crude cottonseed oil the weighted index number for oils and fats moved upward during the month. Linseed oil advanced in price but later receded and closed the month unchanged. China wood oil reached lower levels and the same was true for oleo oils. Tallow and animal fats showed little change.

CURRENT PRICES *in the* NEW YORK MARKET

For Chemicals, Oils and Allied Products

The following prices refer to round lots in the New York Market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to December 15.

Industrial Chemicals

		Current Price	Last Month	Last Year
Acetone, drums	lb.	$0.14 -$0.15	$0.14 -$0.15	$0.12 -$0.13
Acid, acetic, 28%, bbl.	cwt.	3.88 - 4.03	3.88 - 4.03	3.38 - 3.63
Boric, bbl.	lb.	.06½- .07	.06½- .07	.08½- .08½
Citric, kegs	lb.	.46 - .47	.46 - .47	.44½- .45
Formic, bbl.	lb.	.11 - .12	.11 - .12	.11 - .12
Gallic, tech., bbl.	lb.	.50 - .55	.50 - .55	.50 - .55
Hydrofluoric 30% carb.	lb.	.06 - .07	.06 - .07	.06 - .07
Lactic, 44%, tech., light, bbl.	lb.	.12 - .12½	.12 - .12½	.13½- .14
22%, tech., light, bbl.	lb.	.05½- .06	.05½- .06	.06½- .07
Muriatic, 18°, tanks	cwt.	.85 - .90	.85 - .90	.85 - .90
Nitric, 36°, carboys	lb.	.05 - .05½	.05 - .05½	.05 - .05½
Oleum, tanks, wks.	ton	18.00 -20.00	18.00 -20.00	18.00- 20.00
Oxalic, crystals, bbl.	lb.	.11 - .11½	.11 - .11½	.11 - .11½
Phosphoric, tech., c'bys.	lb.	.08½- .09	.08½- .09	.08½- .09
Sulphuric, 60°, tanks	ton	11.00 -11.50	11.00 -11.50	10.50 -11.00
Tannic, tech., bbl.	lb.	.35 - .40	.35 - .40	.35 - .40
Tartaric, powd., bbl.	lb.	.37½- .38	.37½- .38	.36 - .37
Tungstic, bbl.	lb.	1.00 - 1.20	1.00 - 1.20	1.00 - 1.20
Alcohol, ethyl, 190 n'f., bbl.	gal.	2.68½- 2.71	2.68½- 2.71	3.75 - 4.00
Alcohol, Butyl, dr.	lb.	.18½- .19	.18½- .19	.19 - .20
Denatured, 190 proof				
No. 1 special dr.	gal.	.48 -.....	.48	.48 -.....
No. 5, 188 proof, dr.	gal.	.48 -.....	.48	.48 -.....
Alum, ammonia, lump, bbl.	lb.	.03½- .04	.03½- .04	.03½- .04
Chrome, bbl.	lb.	.05½- .05½	.05½- .05½	.05½- .06
Potash, lump, bbl.	lb.	.02½- .03½	.02½- .03½	.02½- .03½
Aluminum sulphate, com., bags	cwt.	1.40 - 1.45	1.40 - 1.45	1.40 - 1.45
Iron free, bg.	cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Aqua ammonia, 26°, drums	lb.	.03½- .04	.03½- .04	.03 - .04
Ammonia, anhydrous, cyl.	lb.	.13½-.....	.13½-.....	.12 - .13
Ammonium carbonate, powd. tech., casks	lb.	.12 - .13	.12 - .13	.10½- .14
Sulphate, wks.	cwt.	2.40 -.....	2.40 -.....	2.40 -.....
Amylacetate tech., drums	gal.	1.75 - 2.00	1.75 - 2.00	1.75 - 2.00
Antimony Oxide, bbl.	lb.	.10½- .10½	.12 - .12½	.15 - .16
Arsenic, white, powd., bbl.	lb.	.04 - .04½	.04 - .04½	.04 - .04½
Red, powd., kegs	lb.	.09 - .10	.09 - .10	.09½- .10
Barium carbonate, bbl.	ton	57.50 -60.00	57.50 -60.00	50.00 -52.00
Chloride, bbl.	ton	64.00 -70.00	63.00 -70.00	56.00 -58.00
Nitrate, cask	lb.	.07½- .08	.07½- .08	.08 - .08½
Blanc fixe, dry, bbl.	lb.	.03½- .04	.03½- .04	.04 - .04½
Bleaching powder, f.o.b., wks., drums	cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Borax, bbl.	lb.	.02½- .03	.02½- .03	.04 - .04½
Bromine, cs.	lb.	.45 - .47	.45 - .47	.45 - .47
Calcium acetate, bags	cwt.	4.50 -.....	4.50 -.....	3.50 -.....
Arsenate, dr.	lb.	.06½- .07	.06½- .07	.07 - .08
Carbide drums	lb.	.05 - .06	.05 - .06	.05 - .06
Chloride, fused, dr., wks.	ton	20.00 -.....	20.00 -.....	21.00 -.....
Phosphate, bbl.	lb.	.07 - .07½	.07 - .07½	.07 - .07½
Carbon bisulphide, drums	lb.	.05 - .06	.05 - .06	.05½- .06
Tetrachloride drums	lb.	.06½- .07	.06½- .07	.06½- .07
Chlorine, liquid, tanks, wks.	lb.	.03 - .03½	.03 - .03½	.03½- .04½
Cylinders	lb.	.05 - .08	.05 - .08	.05½- .08
Cobalt oxide, cans	lb.	2.10 - 2.20	2.10 - 2.20	2.10 - 2.25
Copperas, bgs., f.o.b. wks.	ton	16.00 -17.00	16.00- 17.00	14.00 -17.00
Copper carbonate, bbl.	lb.	.17 - .17½	.17 - .17½	.17 - .17½
Cyanide, tech., bbl.	lb.	.49 - .50	.49 - .50	.49 - .50
Sulphate, bbl.	cwt.	5.50 - 5.60	5.50 - 5.70	5.00 - 5.10
Cream of tartar, bbl.	lb	.27½- .28	.27½- .28	.27 - .28
Diethylene glycol, dr.	lb.	.10 - .15	.10 - .15	.15 - .20
Epsom salt, dom., tech., bbl.	cwt.	1.75 - 2.15	1.75 - 2.00	1.75 - 2.00
Imp., tech., bags	cwt.	1.15 - 1.25	1.15 - 1.25	1.15 - 1.25
Ethyl acetate, drums	gal.	1.03 -.....	1.03 -.....	.83 -.....
Formaldehyde, 40%, bbl.	lb.	.09½- .10	.09½- .10	.08½- .09
Furfural, dr.	lb.	.15 - .17½	.15 - .17½	.15 - .17
Fusel oil, crude, drums	gal.	1.30 - 1.40	1.30 - 1.40	1.30 - 1.40
Refined, dr.	gal.	2.50 - 3.00	2.50 - 3.00	2.50 - 3.00
Glaubers salt, bags	cwt.	1.10 - 1.20	1.10 - 1.20	1.00 - 1.10
Glycerine, s.p., drums, extra.	lb.	.14 - .15	.14 - .15	.21½- .22
Lead:				
White, basic carbonate, dry, casks	lb.	.08½-.....	.08½-.....	.09 -.....
White, basic sulphate, sck.	lb.	.07½-.....	.07½-.....	.08½-.....
Red, dry, sck.	lb.	.09½-.....	.09½-.....	.10 -.....
Lead acetate, white crys., bbl.	lb.	.13 - .13½	.13 - .13½	.13 - .13½
Lead arsenate, powd., bbl.	lb.	.13 - .14	.13 - .14	.12 - .13
Lime, chem., bulk	ton	8.50 -.....	8.50 -.....	8.50 -.....
Litharge, pwd., csk.	lb.	.08½-.....	.08½-.....	.09 -.....
Lithopone, bags	lb.	.05½- .06	.05½- .06	.05½- .06½
Magnesium carb., tech., bags	lb.	.06½- .07	.06½- .07	.07½- .08
Methanol, 95%, dr.	gal.	.55 -.....	.55 -.....	.53 -.....
97%, dr.	gal.	.55 -.....	.55 -.....	.55 -.....
Nickel salt, double, bbl.	lb.	.10 - .10½	.10 - .10½	.10 - .10
Single, bbl.	lb.	.10½- .11	.10½- .11	.10½- .11½
Orange mineral, csk.	lb.	$0.11½-.....	$0.11½-.....	$0.11½-.....
Phosphorus, red, cases	lb.	.62 - .65	.62 - .65	.62 - .65
Yellow, cases	lb.	.32 - .33	.32 - .34	.32 - .33
Potassium bichromate, casks	lb.	.08½- .08½	.08½- .08½	.08½- .08½
Carbonate, 80-85%, calc., csk.	lb	.05½- .06	.05½- .06	.05½- .06
Chlorate, powd.	lb.	.06½- .07	.06½- .07	.08½- .09
Cyanide, cs.	lb.	.52 - .55	.52 - .55	.55 - .57
First sorts, csk.	lb.	.08½- .09	.08½- .09	.08½- .09
Hydroxide(c'stic potash) dr.	lb.	.07½- .07¾	.07½- .07¾	.07½- .07½
Muriate, 80% bgs.	ton	36.40 -.....	36.40 -.....	36.40 -.....
Nitrate, bbl.	lb.	.06 - .06½	.06 - .06½	.06 - .07¼
Permanganate, drums	lb.	.16 - .16½	.15 - .16	.15 - .16
Prussiate, yellow, casks	lb.	.19½- .20	.19½- .20	.18 - .19
Sal ammoniac, white, casks	lb.	.046- .05	.047- .05	.05 - .05½
Salsoda, bbl.	cwt.	.90 - .95	.90 - .95	.90 - .95
Salt cake, bulk	ton	14.00 -17.00	14.00 -17.00	17.00 -19.00
Soda ash, light, 58%, bags, contract	cwt.	1.32 -.....	1.32 -.....	1.32 -.....
Dense, bags	cwt.	1.35 -.....	1.35 -.....	1.35 -.....
Soda, caustic, 76%, solid, drums, contract	cwt.	2.80 - 3.00	2.80 - 3.00	3.00 - 3.10
Acetate, works, bbl.	lb.	.05½- .06	.05½- .06½	.04½- .05
Bicarbonate, bbl.	cwt.	2.00 - 2.25	2.00 - 2.25	2.00 - 2.25
Bichromate, casks	lb.	.07 - .07½	.07 - .07½	.06½- .06½
Bisulphate, bulk	ton	3.00 - 3.50	3.00 - 3.50	3.00 - 3.50
Bisulphite, bbl.	lb.	.03½- .03¾	.03½- .03¾	.03½- .04
Chlorate, kegs	lb.	.05½- .06	.05½- .06	.06½- .06½
Chloride, tech.	ton	12.00 -14.75	12.00- 14.75	12.00 -14.00
Cyanide, cases, dom.	lb.	.18 - .22	.18 - .22	.18 - .22
Fluoride, bbl.	lb.	.08½- .09¼	.08½- .09¼	.08½- .09
Hyposulphite, bbl.	lb.	2.50 - 3.00	2.50 - 3.00	2.50 - 3.00
Nitrate, bags	cwt.	2.15 -.....	2.15 -.....	2.40 -.....
Nitrite, casks	lb.	.07½- .08	.07½- .08	.08 - .08½
Phosphate, dibasic, bbl.	lb.	.03 - .03½	.03 - .03½	.03½- .03½
Prussiate, yel. drums	lb.	.11½- .12	.11½- .12	.12 - .12½
Silicate (30°, drums)	cwt.	.75 - 1.15	.75 - 1.15	.75 - 1.15
Sulphide, fused, 60-62%, dr.	lb.	.02½- .03½	.02½- .03	.03½- .04
Sulphite, crys., bbl.	lb.	.02½- .03	.02½- .03	.02½- .03
Strontium nitrate, bbl.	lb.	.09 - .09½	.09 - .09½	.09 - .09½
Sulphur, crude at mine, bulk	ton	18.00 -.....	18.00 -.....	18.00 -.....
Chloride, dr.	lb.	.04 - .05	.04 - .05	.05 - .05½
Dioxide, cyl.	lb.	.09 - .10	.09 - .10	.09 - .10
Flour, bag	cwt.	2.70 - 3.00	2.70 - 3.00	2.70 - 3.00
Tin bichloride, bbl.	lb.	.15½-.....	.15½-.....	.17½-.....
Oxide, bbl.	lb.	.56 -.....	.54 -.....	.64 -.....
Crystals, bbl.	lb.	.38½-.....	.37½-.....	.42 -.....
Zinc chloride, gran., bbl.	lb.	.06½- .06½	.06½- .06½	.06½- .06½
Carbonate, bbl.	lb.	.10 - .11	.10 - .10½	.10 - .11
Cyanide, dr.	lb.	.40 - .41	.40 - .41	.40 - .41
Dust, bbl.	lb.	.08½- .09	.08½- .09	.09 - .10
Zinc oxide, lead free, bag.	lb.	.06½-.....	.06½-.....	.06½-.....
5% lead sulphate, bags	lb.	.06½-.....	.06½-.....	.06½-.....
Sulphate, bbl.	cwt.	2.75 - 3.00	2.75 - 3.00	2.75 - 3.00

Oils and Fats

		Current Price	Last Month	Last Year
Castor oil, No. 3, bbl.	lb.	$0.12½-$0.13	$0.12½-$0.13	$0.13 -$0.13½
Chinawood oil, bbl.	lb.	.14½-.....	.15½-.....	.15½-.....
Coconut oil, Ceylon, tanks, N. Y.	lb.	.08½-.....	.08½-.....	.08½-.....
Corn oil crude, tanks, (f.o.b. mill)	lb.	.08½-.....	.08½-.....	.09½-.....
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.08½-.....	.07½-.....	.08½-.....
Linseed oil, raw, car lots, bbl.	lb.	.10 -.....	.10 -.....	.096-.....
Palm, Lagos, casks	lb.	.09 -.....	.09 -.....	.08 -.....
Niger, casks	lb.	.08½-.....	.08½-.....	.07½-.....
Palm Kernel, bbl.	lb.	.09½-.....	.09½-.....	.09 -.....
Peanut oil, crude, tanks(mill)	lb.	.10 -.....	.10 -.....	.09½-.....
Rapeseed oil, refined, bbl.	gal.	.82 - .84	.88 - .90	.85 - .86
Soya bean tank (f.o.b. Coast)	lb.	.09½-.....	.09½-.....	.09½-.....
Sulphur (olive foots), bbl.	lb.	.10½-.....	.10½-.....	.10 -.....
Cod, Newfoundland, bbl.	gal.	.65 - .67	.65 - .67	.63 - .65
Menhaden, light pressed, bbl.	gal.	.60 - .61	.60 - .61	.60 - .62
Crude, tanks(f.o.b. factory)	gal.	.48 -.....	.42½-.....	.44 -.....
Whale, crude, tanks	gal.	.78 -.....	.73 -.....	.....-.....
Grease, yellow, loose	lb.	.07½-.....	.07½-.....	.06½-.....
Oleo stearine	lb.	.10½-.....	.10½-.....	.12½-.....
Red oil, distilled, d.p. bbl.	lb.	.09½- .09¾	.09½- .09¾	.09½- .09¾
Tallow, extra, loose	lb.	.09¼-.....	.08¾-.....	.08¾-.....

Coal-Tar Products

		Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl.	lb.	$0.60 -$0.65	$0.60 -$0.65	$0.60 -$0.62
Refined, bbl.	lb.	.80 - .85	.80 - .85	.85 - .90
Alpha-naphthylamine, bbl.	lb.	.32 - .34	.32 - .34	.35 - .36
Aniline oil, drums, extra	lb.	.14½- .15	.14½- .15	.15 - .16
Aniline salts, bbl.	lb.	.24 - .25	.24 - .25	.24 - .25
Anthracene, 80%, drums	lb.	.60 - .65	.60 - .65	.60 - .65

Coal Tar Products (Continued)

		Current Price	Last Month	Last Year
Benzaldehyde, U.S.P., dr.	lb.	1.15 - 1.25	1.15 - 1.35	1.15 - 1.25
Benzidine base, bbl.	lb.	.65 - .70	.65 - .70	.70 - .72
Benzoic acid, U.S.P., kgs.	lb.	.57 - .60	.57 - .60	.58 - .60
Benzyl chloride, tech, dr.	lb.	.25 - .26	.25 - .26	.25 - .26
Benzol, 90%, tanks, works	gal.	.23 - .25	.23 - .25	.24 - .25
Beta-naphthol, tech., drums	lb.	.22 - .24	.22 - .24	.22 - .24
Cresol, U.S.P., dr.	lb.	.14 - .17	.14 - .17	.18 - .20
Cresylic acid, 97%, dr., wks	gal.	.73 - .75	.73 - .75	.61 - .62
Diethylaniline, dr.	lb.	.55 - .58	.55 - .58	.58 - .60
Dinitrophenol, bbl.	lb.	.30 - .32	.30 - .31	.31 - .35
Dinitrotoluen, bbl.	lb.	.17 - .18	.17 - .18	.17 - .18
Dip oil, 25% dr.	gal.	.28 - .30	.28 - .30	.28 - .30
Diphenylamine, bbl.	lb.	.43 - .45	.43 - .45	.45 - .47
H-acid, bbl.	lb.	.60 - .63	.60 - .63	.63 - .65
Naphthalene, flake, bbl.	lb.	.05 - .06	.05 - .06	.04½ - .05
Nitrobensene, dr.	lb.	.09 - .10	.09 - .10	.09 - .10
Para-nitraniline, bbl.	lb.	.55 - .56	.55 - .56	.52 - .53
Para-nitrotoluine, bbl.	lb.	.28 - .32	.28 - .32	.28 - .32
Phenol, U.S.P., drums	lb.	.13 - .14	.13 - .14	.18 - .19
Picric acid, bbl.	lb.	.30 - .40	.30 - .40	.30 - .40
Pyridine, dr.	lb.	1.35 - 1.50	1.35 - 1.50	3.00 - .....
R-salt, bbl.	lb.	.44 - .45	.44 - .45	.47 - .50
Resorcinal, tech, kegs.	lb.	1.30 - 1.35	1.30 - 1.35	1.30 - 1.40
Salicylic acid, tech., bbl.	lb.	.30 - .32	.30 - .32	.30 - .32
Solvent naphtha, w.w.,tanks	gal.	.30 - .35	.30 -	.35 - .....
Tolidine, bbl.	lb.	.86 - .90	.86 - .90	.95 - .96
Toluene, tanks, works	gal.	.50 -	.40 -	.35 - .....
Xylene, com., tanks	gal.	.30 - .35	.30 - .35	.36 - .40

Miscellaneous

		Current Price	Last Month	Last Year
Barytes, grd., white, bbl.	ton	$23.00-$25.00	$23.00-$25.00	$23.00-$25.00
Casein, tech., bbl.	lb.	.16½ - .17	.16½ - .17	.17½ - .18
China clay, dom.,f.o.b. mine	ton	10.00 -20.00	10.00 -20.00	10.00 -20.00
Dry colors:				
Carbon gas, black (wks.)	lb.	.07½ - .08	.07½ - .08	.06½ - .07
Prussian blue, bbl.	lb.	.31 - .33	.31 - .33	.33 - .34
Ultramine blue, bbl.	lb.	.08 - .35	.08 - .35	.08 - .35
Chrome green, bbl.	lb.	.27 - .31	.27 - .30	.27 - .30
Carmine red, tins	lb.	5.25 - 5.50	5.25 - 5.50	5.50 - 5.75
Para toner	lb.	.60 - .70	.60 - .70	.80 - .90
Vermilion, English, bbl.	lb.	1.80 - 1.85	1.80 - 1.85	1.80 - 1.85
Chrome yellow, C. P., bbl.	lb.	15½ - .16	15½ - .16	.17 - .18
Feldspar, No. 1 (f.o.b. N. C.)	ton	5.75 - 7.00	5.75 - 7.00	5.75 - 7.00
Graphite, Ceylon, lump, bbl.	lb.	.08 - .08½	.08 - .08½	.08 - .09
Gum copal, Congo, bags.	lb.	.07½ - .08	.07½ - .08	.09½ - .10
Manila, bags	lb.	.15 - .18	.15 - .16	.15 - .18
Damar, Batavia, cases	lb.	.22 - .23	.22 - .23	.25 - .25
Kauri, No. 1 cases	lb.	.48 - .53	.48 - .53	.55 - .57
Kieselguhr (f.o.b. N. Y.)	ton	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc.	ton	40.00 -	40.00 -	44.00 - .....
Pumice stone, lump, bbl.	lb.	.05 - .07	.05 - .08	.05 - .07
Imported, casks	lb.	.03 - .40	.03 - .40	.03 - .35
Rosin, H.	bbl.	9.50 -	9.60 -	8.00 - .....
Turpentine	gal.	.59 -	.55½ -	.56 - .....
Shellac, orange, fine, bags	lb.	.61 -	.61 -	.59 - .61
Bleached, bonedry, bags	lb.	.56 - .60	.60 - .66	.62 - .65
T. N. bags	lb.	.46 - .47	.47 - .48	.55 - .56
Soapstone (f.o.b. Vt.), bags	ton	10.00 -12.00	10.00 -12.00	10.00 -12.00
Talc, 200 mesh (f.o.b. Vt.)	ton	9.50 -	9.50 -	10.50 - .....
300 mesh (f.o.b. Ga.)	ton	7.50 -10.00	7.50 -10.00	7.50 -11.00
225 mesh (f.o.b. N. Y.)	ton	13.75 -	13.75 -	13.75 - .....
Wax, Bayberry, bbl.	lb.	$0.31 -$0.32	$0.31 -$0.32	$0.22 -$0.26
Beeswax, ref., light	lb.	.41 - .42	.41 - .42	.43 - .45
Candelilla, bags	lb.	.23 - .24	.23 - .24	.27 - .28
Carnauba, No. 1, bags	lb.	.46 - .48	.46 - .48	.62 - .63
Paraffine, crude 105-110 m.p.	lb	04½ - 05	04½ - .05	05½ - .06

Ferro-Alloys

		Current Price	Last Month	Last Year
Ferrotitanium, 15-18%	ton	$200.00-	$200.00-	$200.00- .....
Ferromanganese, 78-82%	ton	105.00-	105.00-	90.00- .....
Spiegeleisen, 19-21%	ton	33.00-	32.00-	33.00-35.00
Ferrosilicon, 14-17%	ton	45.00-	45.00-	.....
Ferrotungsten, 70-80%	lb.	.95- .98	.95- .98	.95- .98
Ferro-uranium, 35-50%	lb.	4.50-	4.50-	4.50-
Ferrovanadium, 30-40%	lb.	3.15- 3.75	3.15- 3.75	3.15- 3.75

Non-Ferrous Metals

		Current Price	Last Month	Last Year
Copper, electrolytic	lb.	$0.16 -	$0.15½ -	$0.13½ - .....
Aluminum, 96-99%	lb.	.24 - .26	.24 - .26	.25 - .26
Antimony, Chin. and Jap.	lb.	.11½ -	.11½ -	.11 - .....
Nickel, 99%	lb.	.35 -	.35 -	.35 - .....
Monel metal, blocks	lb.	.28 -	.28 - .28	.32 - .33
Tin, 5-ton lots, Straits	lb.	.49 -	.49 -	.58½ - .....
Lead, New York, spot	lb.	6.50 -	6.50 -	6.50 - .....
Zinc, New York, spot	lb.	6.70 -	6.60 -	6.15 - .....
Silver, commercial	oz.	.57½ -	.58½ -	.57½ - .....
Cadmium	lb.	.70 - .80	.70 - .80	.60 - .....
Bismuth, ton lots	lb.	1.70 -	1.70 -	1.85 - 2.10
Cobalt	lb.	2.50 -	2.50 -	2.50 - .....
Magnesium, ingots, 99%	lb.	.85 - 1.10	.85 - 1.10	.75 - .80
Platinum, ref.	oz.	76.00- 76.50	76.00- 76.50	66.00- .....
Palladium, ref.	oz.	42.00- 46.00	42.00- 46.00	52.00-53.00
Mercury, flask	75 lb.	122.00-	123.00-	128.00- .....
Tungsten powder	lb.	1.10- 1.15	1.10- 1.15	1.05- .....

Ores and Semi-finished Products

		Current Price	Last Month	Last Year
Bauxite, crushed, wks.	ton	$7.50- $8.00	$7.50- $8.50	$5.50- $8.75
Chrome ore, c.f. post	ton	21.00- 23.00	22.00- 24.00	22.00- 23.00
Coke, fdry., f.o.b. ovens	ton	2.85- 3.00	2.85- 3.00	3.25- 3.75
Fluorspar, gravel, f.o.b. Ill.	ton	17.00- 18.00	17.00- 18.00	17.00- .....
Ilmenite, 52% TiO_2, Va.	lb.	.00¾ - .00¾	.00¾ - .00¾	.00¾ - .....
Manganese ore, 50% Mn., c.i.f. Atlantic Ports	unit	.36 - .38	.36 - .38	.36 - .38
Molybdenite, 85% MoS_2 per lb. MoS_2, N. Y.	lb.	.48 - .50	.48 - .50	.48- .50
Monazite, 6% of ThO_2	ton	130.00-	130.00-	120.00- .....
Pyrites, Span. fines, c.i.f.	unit	.13 -	.13 -	.13½ - .....
Rutile, 94-96% TiO_2	lb.	.11 - .13	.11 - .13	.11 - .13
Tungsten, scheelite, 60% WO_3 and over	unit	11.25 -11.50	11.25 -11.50	11.25 -11.50
Vanadium ore, per lb. V_2O_5	lb.	nom.	nom.	.25 - .28
Zircon, 99%	lb.	.03 -	.03 -	.03 - .....

CURRENT INDUSTRIAL DEVELOPMENTS

New Construction and Machinery Requirements

Acetylene Plant — Air Reduction Sales Co., 342 Madison Ave., New York, N. Y., will build a 1 story acetylene plant at Flint, Mich. Estimated cost $40,000. Private plans. Work will be done by day labor.

Brass Foundry—Chase Brass & Copper Co., C. E. Hart, Jr., Secy., Waterbury, Conn., awarded contract for a 1 story, 225 x 1,000 ft. foundry, at Euclid, O., to Austin Co., 16112 Euclid Ave., Cleveland, O. Estimated cost $1,250,000.

Brass Foundry—Sterling Brass Co., S. L. Weil, Pres., 9600 St. Catherine Ave., Cleveland, O., awarded contract for a 3 story, 44 x 144 ft. addition to factory to J. Miller, 10819 Drexel Ave., Cleveland, O. Estimated cost $60,000.

Brick Plant—A. P. Green Fire Brick Co., Mexico, Mo., awarded contract for the construction of a tunnel kiln for fire brick plant, 36,000 brick daily capacity, to H. K. Ferguson Co., Hanna Bldg., Cleveland, O. Estimated cost $300,000.

Carbonization Plant—International Combustion Engineering Corp., 200 Madison Ave., New York, will build a carbonization plant at Coatesville, Pa. Estimated cost $1,000,000. Private plans. Work will be done by separate contracts.

Cement Plant—Canada Cement Co. Ltd., Phillips Sq., Montreal, Que., plans the construction of a warehouse for cement plant on St. Andrew St., Quebec City, Que. Estimated cost $1,000,000.

Chemical Factory—W. O. Ellis Co., Concord Junction, Mass., will build a 1 story chemical factory at Concord Junction. Private plans. Work will be done by separate contracts.

Chemical Plant—Peroxide Chemical Co., J. P. Brunner, Pres., 6300 Etzel Ave., St. Louis, Mo., awarded contract for a 1 story, 98 x 130 ft. chemical plant at Etzel and Wabash Ry., to W. O. Harting, International Life Bldg., St. Louis, Mo. Estimated cost $40,000.

Chemical and Drug Plant—Hoffman La Roche Co., 19 Cliff St., New York, N. Y., awarded contract for a group of buildings for chemical and drug plant at Nutley, N. J., to J. W. Ferguson Co., 152 Machet St., Paterson, N. J. Estimated cost $150,000.

Chemical and Pigment Plant Addition—Chemical and Pigments Co., W. J. O'Brien, V. Pres. and Mgr., St. Helena, Md., will build an addition to plant. Estimated cost $100,000.

Chromium Factory — U. S. Chromium Corp., Wilkinsburg, Pa., is having preliminary plans prepared for a 1 story, 72 x 100 ft. factory at Wallace Ave. and Pitt St. Estimated cost $50,000. Architect not selected.

Compressed Gas Plant—Prest-O-Lite Co., 1520 West 35th St., Chicago, Ill., is having preliminary plans prepared for the construction of a compressed gas plant at Oklahoma City, Okla. Private plans. Machinery and equipment to cost $150,000 will be required. Estimated cost $50,000.

Corrugated Box Factory — Corrugated Paper Box Co., 187 Geary Ave., Toronto, Ont., plans the construction of a 1 and 2 story, 200 x 700 and 150 x 200 ft. factory at Leaside, Ont. Estimated cost $350,000. G. E. Treloar, 32 Duart Park Rd., Toronto, Ont., Archt. Owner is in the market for paper box making equipment, corrugator, motors, etc.

Concentration and Reduction Plant—St. Louis Smelting & Refining Co., 722 Chestnut St., St. Louis, Mo., is having preliminary plans prepared for the construction of a concentration and reduction plant, for lead mine near Fredericktown, Mo. Private plans.

Feldspar Plant—American Mineral Products Co., Inc., Walpole, N. H., awarded contract for a 1 story, 60 x 230 ft. feldspar grinding plant on Gold River to Aberthaw Construction Co., 80 Federal St., Boston, Mass. Estimated cost $160,000.

Fertilizer Plant—Davison-Pick Fertilizer Inc., Whiteney Bldg., New Orleans, La., c/o M. R. Morton, Orange, Tex., Mgr., have acquired a site at Orange, Tex., and plans the construction of a fertilizer plant. Estimated cost $500,000. Machinery and equipment will be required.

Gas Plant—Piedmont Gas Co., Hickery, N. C., awarded contract for the construction of a 1 story gas plant to A. A. Whittock Co., Berwich, Pa. Estimated cost $400,000. J. V. Nichols, Percival, Va., is interested.

Gasoline Plant—Phillips Petroleum Co., Bartlesville, Okla., is having preliminary plans prepared for the construction of a four unit casinghead gasoline plant in Jones County, Tex. Estimated cost $60,000. A. H. Riney, Bartlesville, Okla., is engineer.

Glass Plant — Ford Plate Glass Co., Rossford, O., awarded contract for the construction of a 250 x 300 ft. and 140 x 1,100 ft. plate glass factory to A. Bentley & Sons Co., Belmont St., Toledo, O. Equipment will be installed.

Glass Plant Addition—Pittsburgh Plate Glass Co., Frick Bldg., Pittsburgh, Pa., will build a 2 story, 100 x 1,000 ft. addition to glass plant at Crystal City, Mo. Estimated cost $750,000. Work will be done by separate contracts.

Gold Leaf—M. Swift & Sons, 100 Love Lane, Hartford, Conn., is having revised plans prepared for the construction of a 2 story, 55 x 200 ft. factory. Estimated cost $100,000. Mychreest & Reynolds, 238 Palm St., Hartford, Conn., are architects.

Hydro-Chemical Plant — Oswego Industries Corp., 15 Broad St., New York, N. Y., is having plans prepared for the construction of a hydro-chemical plant at Oswego. Estimated cost $700,000. E. E. Whitney, East Bridge St., Oswego, is architect.

Ink Plant—Hill-Hentschel Ink Co., 622 North Main St., St. Louis, Mo., plans the construction of a 2 story, 75 x 162 ft. ink plant at Laclede and Sarah Sts. Estimated cost $60,000.

Kraft Paper Mill—International Paper Co., Park Ave. and 42nd St., New York, plans the construction of a kraft paper mill, 200 ton daily capacity in one of the southern states, location not decided.

Laboratory — Brooklyn Union Gas Co., 176 Remsen St., Brooklyn, N. Y., awarded contract for a 2 story laboratory at Maspeth and Varick Aves., to William F. Kenny Co., 44 East 23rd St., New York, N. Y. Estimated cost $60,000.

Laboratory—Celenese Corp. of America, Cumberland, Md., will soon award contract for the construction of a 2 story, 88 x 145 ft. laboratory. F. T. Small, c/o owner, is architect.

Laboratory—J. P. Devine Mfg. Co., 1372 Clinton St., Buffalo, N. Y., manufacturers of chemical apparatus, vacuum dryers, evaporators, impregnators, etc., will build a factory including laboratory at Mount Vernon, Ill. Estimated cost $600,000. Work will be done by owner's forces.

Laboratory, etc.—Constructing Quartermaster, U. S. Army, Picatinny Arsenal, N. J., awarded contract for an administration building, thirteen buildings for laboratory aren, twenty-one buildings for melting loading area and three buildings for shop area, to Van Asdlen Construction Co., 1600 Arch St., Philadelphia, Pa. Estimated cost $793,516.

Laboratories, etc. — Kingsway Hospital Constructors Inc., 50 Court St., Brooklyn, N. Y., is having plans prepared for the construction of a 4 story hospital, including laboratories, etc. Estimated cost $1,000,000.

Laboratories (Chemistry and Physics)—North Carolina College for Negroes, R. L. Flowers, Chn. Bd. of Trustees, Durham, N. C., awarded contract for the construction of a group of college buildings, including chemistry and physics laboratories, etc., to G. W. Kane, First National Trust Bldg., Durham, N. C. Estimated cost $150,000.

Lacquer Plant—Berry Bros. Inc., 211 Leib St., Detroit, Mich., will soon award contract for a 4 story, 65 x 90 ft. lacquer plant. Estimated cost $100,000. Smith, Hinchman & Grylls, 800 Marquette Bldg., Detroit, Mich., are architects. Owner is in the market for pump, tanks, piping, etc.

Lacquer Plant—Cook Paint & Varnish Co., North Kansas City, Mo., awarded contract for the construction of a 3 story, 60 x 113 ft. lacquer plant, to Collins Construction Co., Davidson Bldg., Kansas City, Mo. Estimated cost $50,000.

Ore Reclaiming Plant—Utah Copper Co., Salt Lake City, Utah, will build an ore reclaiming plant at Bingham Canyon. Estimated cost $75,000. Private plans. Work will be done by day labor.

Paint Factory—Stewart Bros. Paint Co. Inc., 204 South Seneca Ave., Alliance, O., awarded contract for the construction of a 2 story plain factory at Spartanburg, S. C., to Fiske-Carter Construction Co., Spartanburg, S. C. Estimated cost $40,000.

Paint and Varnish Factory—Flint Paint & Varnish Co., Regina, Sask., plans the construction of a new plant. Estimated cost $250,000.

Paperboard Plant — Hinde & Dauche Paper Co., 45 Hanna St., Toronto, Ont., awarded contract for 4 story, 150 x 400 ft. addition to paperboard plant to H. N. Dancy & Son Ltd., 22 College St., Toronto, Ont. Estimated cost $300,000. Owner is in the market for electric motors, pumps and all equipment.

Paper Box Factory—Parkersburg Corrugated Box Co., Parkersburg, W. Va., awarded contract for a 1 story, 50 x 290 ft. addition to paper box factory to Plate Construction Co., Parkersburg, W. Va. Estimated cost $100,000.

Paper Mill — Warren Mfg. Co., Bloomsbury, N. J., awarded contract for the construction of a 1 story paper mill, to Austin Co., 16112 Euclid Ave., Cleveland, O. Estimated cost $60,000.

Paper Plant—Canada Pad & Paper Co., 109 Simcoe St., Toronto, Ont., is having plans prepared for the construction of a 4 story, 105 x 105 ft. paper plant on Madison Ave. Estimated cost $200,000. N. A. Armstrong & Co., 7 King St. E., Toronto, Cnt., are architects.

Paper Products Plant—Fairmount Paper Products Co., Fairmount, Ind., plans to rebuild plant recently destroyed by fire. Loss $150,000. Owner will purchase machinery and equipment.

Porcelain Plant — California Porcelain Co., c/o D. E. Jaekle, 395 Justin Way, San Francisco, Calif., Archt., is having plans prepared for the construction of a plant at Richmond. Estimated cost $40,000.

Porcelain Plant—Washington Porcelain Co., Washington, N. J., will soon award contract for a 2 story, 35 x 132 ft. plant. Estimated cost $50,000. Mylchreest & Reynolds, 238 Palm St., Hartford, Conn., are architects and engineers.

Potash Refinery—American Potash Co., Dallas, Tex., plans the construction of a potash refinery, 2,000 raw product daily capacity at Odessa, Tex. Estimated cost $250,000. Private plans.

Process Building—American Paper Tube Co., Hazel St., Woonsocket, R. I., awarded contract for a 1 story addition to process building, to J. F. Fleurant & Sons Inc., 18 Oak Hill Ave. Estimated cost $40,000. W. F. Fontaine, 285 Main St., Woonsocket, R. I., is architect.

Pulp Mill—Vancouver Kraft Co. Ltd., Oregonian Bldg., Portland, Ore., plans reconditioning and extending pulp mill at Port Mellon, B. C. Estimated cost $2,000,000. C. Brown, c/o owner, is engineer.

Pyrolin Products Factory — Pyrolin Products Inc., 1800 West 74th Pl., Chicago, Ill., awarded contract for the construction of a 2 story, 40 x 115 ft. factory at 4851-53 South St. Louis Ave., to Porist Construction Co., 38 South Dearborn St., Chicago, Ill.

Refinery (Oil)—Anderson-Pritchard Co., plans the installation of two high pressure cracking stills to increase capacity of oil refinery at Cyril, Okla. Estimated cost $50,000.

Refinery (Oil)—Wilcox Oil & Gas Co., 310 West 6th St., Tulsa, Okla., is having plans prepared for the construction of a 2,000 bbl. oil refinery at Bristow. Estimated cost $40,000. Private plans.

Refinery (Oil) Addition—Barnsdall Oil Co., Barnsdall, Okla., plans addition to oil refinery. Estimated cost $30,000. Work will be done by owners' forces.

Refinery (Oil) Addition — Canfield Oil Co., C. McLean, V. Pres., 3216 East 55th St., Cleveland, O., plans the construction of a 1 story addition to oil refinery at East 55th St. and W. & L. E. R.R. Estimated cost $40,000. L. Carrouth, c/o owner, is engineer.

Refinery (Oil) and By-Products Plants—Shell Union Oil Co., 65 Broadway, New York, N. Y., voted $30,000,000 stock issue for extensions and improvements to oil refinery and by-products plants at Louisiana, California and Missouri. Private plans.

Refinery (Sugar) — National Artichoke Products Co., W. D. Fast, Pres., Big Rapids, Mich., is having plans prepared for the construction of an artichoke sugar refinery. Estimated cost $100,000. Architect not selected.

Rubber Factory—Canadian Goodrich Co., J. W. Jordan, Mgr., Kitchener, Ont., awarded contract for addition to rubber factory on King St. W., to Dunker Bros., 58 Louisa St., Kitchener. Estimated cost $250,000.

Rubber Factory Addition — Sieberling Tire & Rubber Co., Barberton, O., plans a 3 story, 80 x 100 ft. addition to rubber factory. Estimated cost $75,000.

Starch Plant Addition—Canada Starch Co. Ltd., Cardinal, Ont., will build a 2 story, 85 x 160 ft. addition to starch plant by day labor. Estimated cost $150,000. J. H. Hunter, 164 St. James St., Montreal, Que., is architect.

Steel Fabricating Shop — Toronto Iron Works, ft. of Cherry St., Toronto, Ont., plans the construction of a 1 story steel fabricating shop. Estimated cost $500,000. Private plans.

Steel Mill—Youngstown Sheet & Tube Co., J. A. Campbell, Pres., Stambaugh Bldg., Youngstown, O., is having plans prepared for the construction of four open hearth furnaces, and two bar mills to increase capacity of steel mill at South Chicago, Ill. Private plans.

Steel Plant Addition—Steel Co. of Canada Ltd., Harvey Lane, Hamilton, Ont., will build 1 and 2 story additions to steel plant. Estimated cost $7,000,000. Private plans. Work will be done by day labor.

Sulphite Mill—Algonquin Paper Co., Ogdensburg, N. Y., plans the construction of a new sulphite mill.

INDUSTRIAL NOTES

THE MONSANTO CHEMICAL WORKS, St. Louis, announces that its president will now be assisted by John D. Gillis, formerly president of John P. Milliken & Company, recently absorbed by the Abbot Laboratories of Chicago.

THE GEORGIA PINE TURPENTINES COMPANY'S head office is now located at Fayetteville, N. C.

THE ASH GROVE LIME & PORTLAND CEMENT COMPANY, Kansas City, Mo., has promoted A. Lundteigen to vice-president in charge of all plants.

THE GENERAL AMERICAN TANK CAR CORPORATION, Chicago, has installed a new tank car department with L. S. Belding, formerly of the American Welding Company, in charge.

COLT'S PATENT FIRE ARMS MANUFACTURING COMPANY, Hartford, Conn., has located a new Chicago office at 618 West Jackson Boulevard, where a stock room will also be maintained. The branch offices of the molded products division is likewise incorporated, with G. A. Saylor in charge.

THE ORELITE COMPANY, INC., producer of diatomaceous earth, has elected S. Janovici president-treasurer and J. G. Mason, Jr., vice-president-secretary.

FOOTE BROS. GEAR & MACHINE COMPANY recently acquired interest in the following firms: Lyle Culvert & Road Equipment Company, Stockland Road Machinery Company, Northwestern Steel & Iron Corporation, Minneapolis, Minn., and Bates Mfg. Company, Joliet, Ill.

BOTTFIELD REFRACTORIES COMPANY has appointed McCarthy-Jones & Allen Company, 111 First Ave., Nashville, Tenn., and The Marshall Supply Co., Pittsburg, Kan. and Tulsa, Okla., distributors of its products.

ADAM HILGER, LTD., 20 Rochester Road, London, England, offers for sale a stock of rare elements and salts of highest purity, some prepared by the late Sir William Crookes.

THE JEFFREY MANUFACTURING COMPANY, Columbus, Ohio, has appointed S. M. Mercier manager of its Boston office at 141 Milk St.

THE C. O. BARTLETT & SNOW COMPANY has placed L. S. Shaffer in charge of sales and development of its new handling equipment for mixed concrete.

THE PENNSYLVANIA PUMP & COMPRESSOR COMPANY, Easton, Pa., has appointed as representatives J. F. Rodgers, 726 Oliver Building, Pittsburgh, and Gustavo Preston, 113 Broad St., Boston.

THE NATIONAL FLUE CLEANER COMPANY, INC., of Groveville, N. J., has appointed the Graun-Liebing Company of Cleveland, Dennis Engineering Company of Columbus, and Bishop Engineering Company of Cincinnati as sales agents.

THE BAKER-RAULANG COMPANY, Cleveland, Ohio, has made A. J. Gates its chief sales executive in charge of national distribution of transporting and handling units.

THE U. S. STONEWARE COMPANY will be represented in the Southwest by the Western Precipitation Company of 1916 West 9th St., Los Angeles, Calif.

THE WAGNER ELECTRIC CORPORATION has appointed the following branch managers: H. H. Felton, New York; F. T. Coup, Milwaukee, and P. F. Forsyth, Cincinnati.

Only FLETCHER gives you an *Underdriven* CENTRIFUGAL *with bottom discharge*

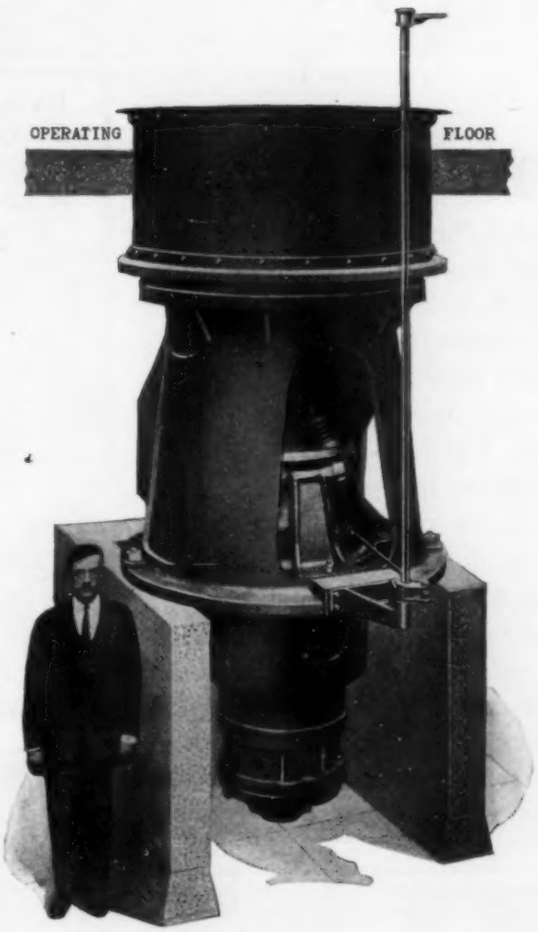
HERE is a Fletcher centrifugal that is simple in construction with a wealth of responsive power, that is economical, safe and easy to operate. The operator is able to handle large quantities of material with the least attention and with little effort. The open top permits free access to the basket from all sides, greatly facilitating operation.

Large steel springs enable the machine to operate successfully even with badly unbalanced loads. It is practically never necessary to stop the machine to readjust the load, and the saving in time and labor is easily apparent.

This Fletcher centrifugal rests on a foundation below the operating platform, thus relieving it of the machine. This feature frequently results in a saving in installation cost.

Fletcher sturdiness of construction, protected bearings and re-inforced baskets are other valuable features of this Underdriven bottom discharge centrifugal.

All details are given in Bulletin 25. Write.



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Formerly SCHAUM & UHLINGER
Glenwood Avenue at Second Street, Philadelphia, U. S. A.
Established 1850

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Pacific Coast Representatives:
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Come to Centrifugal Headquarters with your problems

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When resistance to both heat and acids is essential PYREX

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pipes or tubes are necessary

PYREX* Pipes and Tubes combine high chemical stability with–

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Resistance to heat and heat shock

High heat transfer as compared with other ceramic materials

Visibility

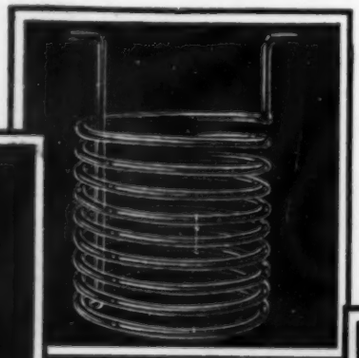
DO YOU seek pipes that will withstand the attack of acids? Pipes highly resistant to heat shock and sudden temperature changes? Pipes that will insure the cleanliness of the liquid passing through them?

Then use *PYREX Piping and Tubing — now widely adopted for the transferring of acids, chemicals and liquid food products.

Of high chemical stability, PYREX Piping and Tubing is immune to the attack of reagents. Of low linear coefficient of expansion, it resists heat shock and sudden temperature changes. Its original diamond-hard, super-smooth surface does not corrode. There is no glaze to craze or check—no pores to pit. It is transparent. And it is available in varying lengths and sizes.

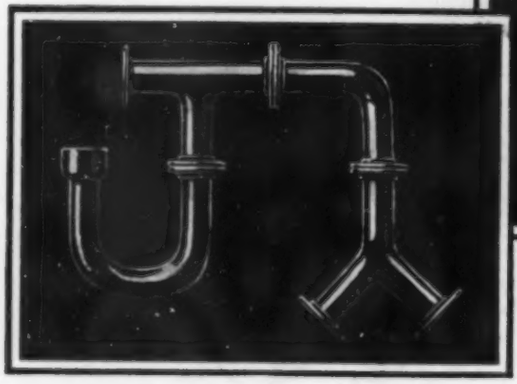
This unique combination of properties present in PYREX Tubing enables it to meet the exacting demands of a great many industries. It is especially valuable where permanence of equipment is demanded and the preservation of the purity of the product essential.

Write for the booklet, PYREX Industrial Glass Products, which presents technical data on properties and performance, and illustrates some of the actual applications by well known organizations of our special glasses.

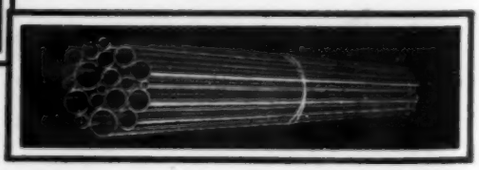


(At left)
PYREX Tubing *is supplied in coils upon request*

PYREX Piping and Tubing *is not affected by corrosive acids or sudden temperature changes. It is particularly valuable when visibility is essential*



(At left)
PYREX Tubes and Connectors *for horizontal and vertical coolers, heaters and condensers withstand corrosion and maintain efficiency*



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Industrial and Laboratory Division, Dept. P-11.

Corning, New York

*Trade-mark Reg. U. S. Pat. Off.

There is no substitute for experience

...when you build a new addition to your plant

WHEN the problem of enlarging your plant comes up—when you consider the question of new equipment, new processes, and new buildings in which to house them—you make sure to secure the services of the most experienced men available. In helping you solve such problems of importance there is no substitute for experience.

Likewise, in placing the contract for your Liquid Chlorine requirements, there is no substitute for valuable experience. The manufacture and distribution of Liquid Chlorine demand elaborate equipment of the most modern type. They require the services of technical men with years of wide experience. They demand the full cooperation of an organization whose broad experience is unchallenged and whose facilities for serving Chlorine purchasers are nation-wide.

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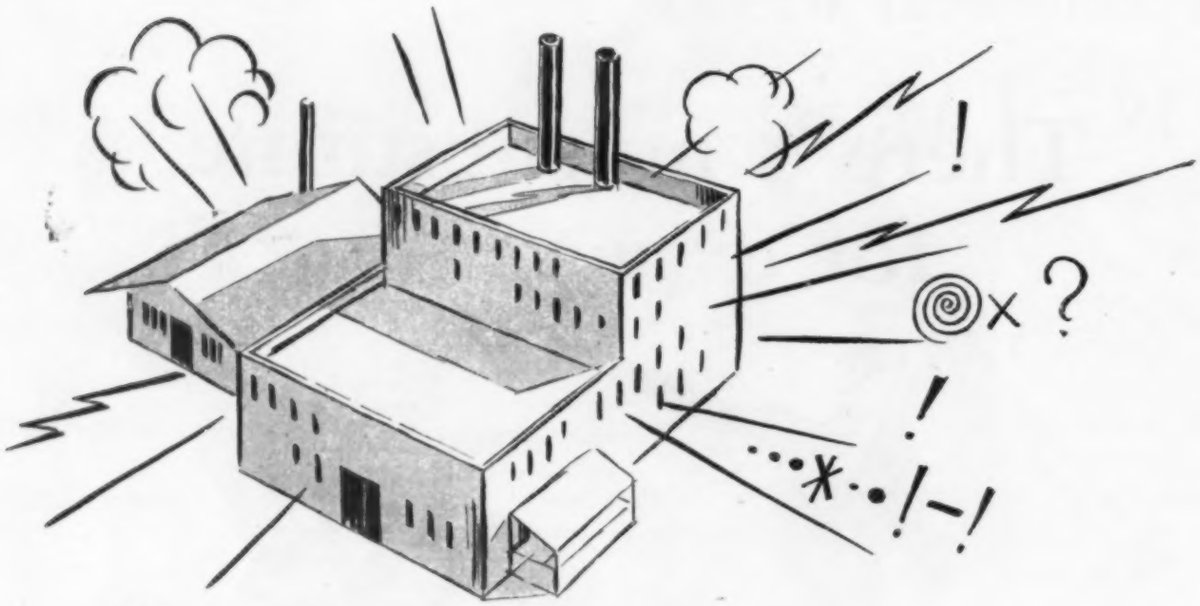

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THE picture above suggests the only guaranteed results of shopping around for job lot material. Raw materials with the accent on the raw!

Bargain-hunting is a constant temptation, of course. But how often is it sound economy?

Better to assume that shaded prices mean shaded quality; and that six lots of the "same" material from six different sources may mean six different results in your plant!

Every drum—every barrel—every carload of U. S. Industrial Alcohol products is identical in quality. We rigidly standardize our products to help you standardize yours.

U. S. INDUSTRIAL ALCOHOL CO.
U. S. INDUSTRIAL CHEMICAL CO., Inc.
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Predominance in the automotive industry offers a sure guide for *any* industry

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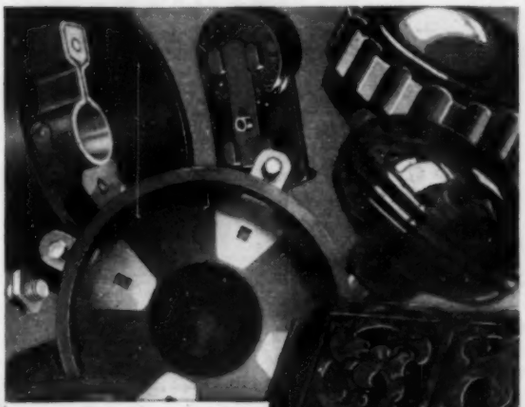

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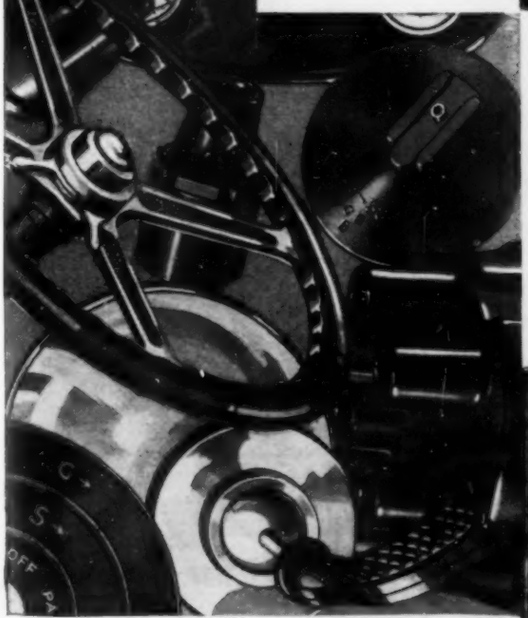
PONTIAC
REO



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and more than eighty trucks, tractors and marine craft carry equipment made of DUREZ

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"DO IT WITH DUREZ"
Contains a wealth of information

DUREZ—the perfect plastic!—enters into the construction or equipment of more automobiles than all other molding compounds combined!

In an industry so fraught with competition of the keenest sort, the adoption of a material or part is no random procedure. The meticulous analyses of research staffs, the racking tests of private proving grounds, the close specifications of the automotive engineer, production schedules calling for speed and economy—all these must be met with absolute certainty.

As a material for molded parts Durez has won by a decisive margin. In some instances possibly because of its greater impact strength. Or its fine appearance. Or its ready workability. Or the uniform toughness, hardness and perfect form with which it comes from the mold. Or the elimination of expensive hand-tooling and burnishing which it enables. Or the splendid dielectric properties it possesses. Or because of its marvelous heat, moisture and oil resistance. . . . But more likely it is because Durez so thoroughly combines *all* the qualities of a perfect molding compound.

The great preference for Durez in an industry calling for such a wide range of diversified parts and applications as the automotive industry, is a reliable guide for *any* industry.

We commend Durez to your earnest consideration. We make Durez molding compound for general or special requirements; and in every practical color. We offer you the cheerful assistance of our laboratory and engineering staff. We will gladly send you complete data regarding this marvelous plastic. Why not investigate the possibilities of Durez toward your own requirements?

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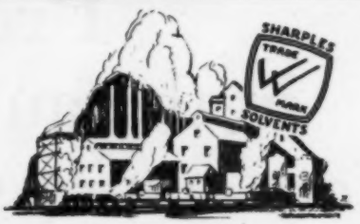

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Should you have any process problems in which one or more of these solvents might be used, let us co-operate with you by forwarding full information as to their properties, and by furnishing working samples for tests in your own plant.

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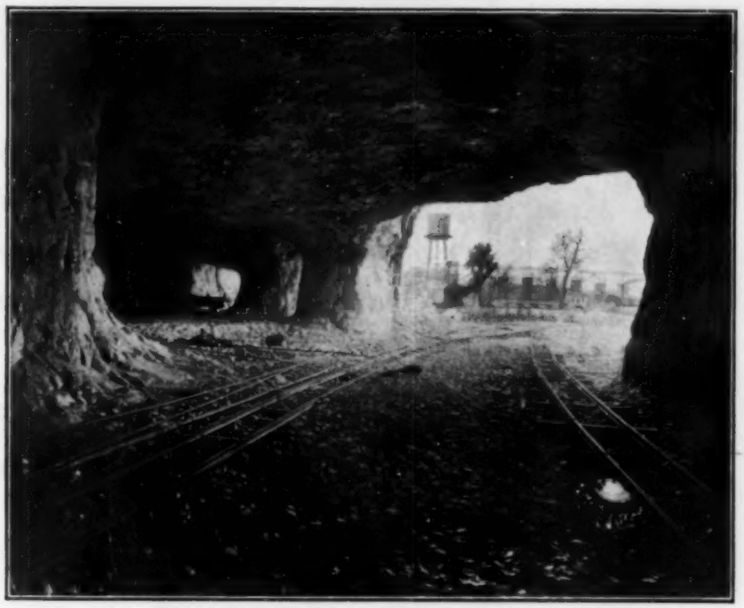

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Established 1875

PEERLESS *White Lime*

The special chemical Lime that's shipped the country over

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(99½%)

EVERY day we mine 3000 to 4000 gross tons. Your business is solicited whether of carload or cargo quantities.

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A synthetic high boiling nitrocellulose and cellulose acetate solvent of unusual strength and purity.

Ethyl Lactate is a product of sharp distillation range and free from those high boiling impurities which usually accompany fermentation esters. Most effective retardant for blushing.

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Hydrocyanic Acid, Liquid
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Sulphur
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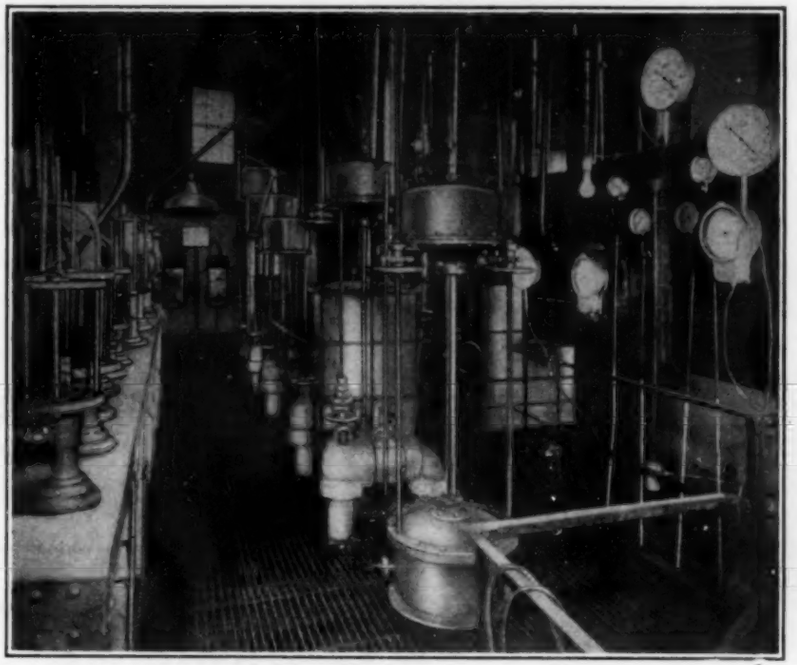
AMERICAN CYANAMID COMPANY
535 Fifth Avenue : New York

AMER SOL
QUALITY - CONTROL SERIES
Bulletin No. 5

SUBJECT: Rigid Automatic Temperature Control in the Production of High-Grade AMER-SOL Alcohol.

At Left

Tail Boxes—which indicate the rate of flow of the distillate from the rectifying column; enable the operator to take hydrometer readings; and provide for laboratory check-ups.



At Right

Automatic Temperature Control Devices. For greatest efficiency all Controls (including Tail Boxes at left) are usually located in one spot.

View in One of the Modern AMER-SOL Alcohol Plants Showing the Use of Temperature Control Devices

in the continuous French Process of Distillation and Rectification.

These temperature devices automatically control the amount of Steam going into the Stills at various points in the system, and the amount of water going into the Separators and Condensers.

A constant rate of flow of feed liquor—constant steam pressure for the stills—and *a constant supply of water* for the separators and condensers are essential for continuous distillation.

For this reason the most rigid temperature control is used in the production of high-grade AMER-SOL ALCOHOL. It should be understood, however, that perfect mechanical control is in itself the result of the highest degree of skill and long experience which are absolutely essential in the most successful operation of the complex, highly sensitive apparatus used in modern distilling.

Such is a brief outline of the factors of *rigid control, experience and equipment* entering into the manufacture of AMER-SOL ALCOHOL—*"Controlled, Tested and Proven for Quality and Uniformity"*

"AMER-SOL Quality-Control Bulletins," describing the successive stages of modern Alcohol manufacture, will be sent to those who make request on their letter head.

AMERICAN SOLVENTS & CHEMICAL *Corporation*

Executive Offices: 285 MADISON AVENUE, NEW YORK

Plants: Harvey, La. Everett, Mass. New Orleans, La. Agnew, Cal. Albany, N. Y.

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(All Formulas)
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Modern Solvents

PRESSURE of competition and the stimulus of chemical research are rapidly banishing the let-well-enough-alone policy from American industry.

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The Common Gases

in five graduated sizes from
½ lb. (2 cu. ft.) to 100 lbs. (150 cu. ft.)
but also

THE RARE GASES

and

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for their control
with

SPECIAL RUBBER TUBING

6 sizes — 3 colors — 2 weights
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Liquid Hydrogen Sulfide
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The Matheson Co.

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Standard Bleaching Powder

Liquid Chlorine

Single Unit Tank Cars — *Multi-Unit Tank Cars (1-ton Containers)*

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Chlorine Distributing Station, Babbitt, N. J.

The Finest Raw Materials

Quality goes through and through in the manufacture of Diamond 58% Soda Ash. The various raw materials are selected for their individual quality with the most meticulous care.

At every important stage of manufacture a corps of expert chemists concentrate their skill and knowledge in safeguarding the quality of Diamond Alkalies. The result is a product which has gained a national reputation for its unvarying purity and uniformity.

DIAMOND ALKALI COMPANY

Pittsburgh, Penna. *and Everywhere*

TO MAKE good alloy steel requires good ferro-alloys. Electro Metallurgical Sales Corporation offers a complete line of ferro-alloys of high quality backed by more than 20 years of experience.

Our Service Department is maintained to demonstrate the proper use and benefits to be derived from these alloys.

. . .

CHROMIUM

High Carbon Ferrochrome (maximum 6% carbon)
Low Carbon Ferrochrome (in grades, maximum 0.10% to maximum 2.00% carbon)
Chromium Metal
Chromium-Copper
Miscellaneous Chromium Alloys

MANGANESE

Standard Ferromanganese 78 to 82%
Low Carbon Ferromanganese
Manganese Metal
Manganese-Silicon (Silico-Manganese)
Manganese-Copper
Miscellaneous Manganese Alloys

SILICON

Ferrosilicon 15%
Ferrosilicon 50%
Ferrosilicon 75%
Ferrosilicon 80 to 85%
Ferrosilicon 90 to 95%
Refined Silicon (minimum 97% silicon)
Calcium-Silicon
Silicon-Copper
Manganese-Silicon or Silico-Manganese
Miscellaneous Silicon Alloys

VANADIUM

All Grades

ZIRCONIUM

Silicon-Zirconium
Zirconium-Ferrosilicon

Greater strength and durability at high temperatures

CHROME STEEL maintains its strength at high temperatures better than carbon steel. Chrome also increases resistance to oxidation and chemical attack.

Chemists and Mechanical Engineers may prolong the life of equipment subject to corrosion by the use of chrome steel.

Our Service Department will be pleased to recommend the kind of steel best suited for your needs.

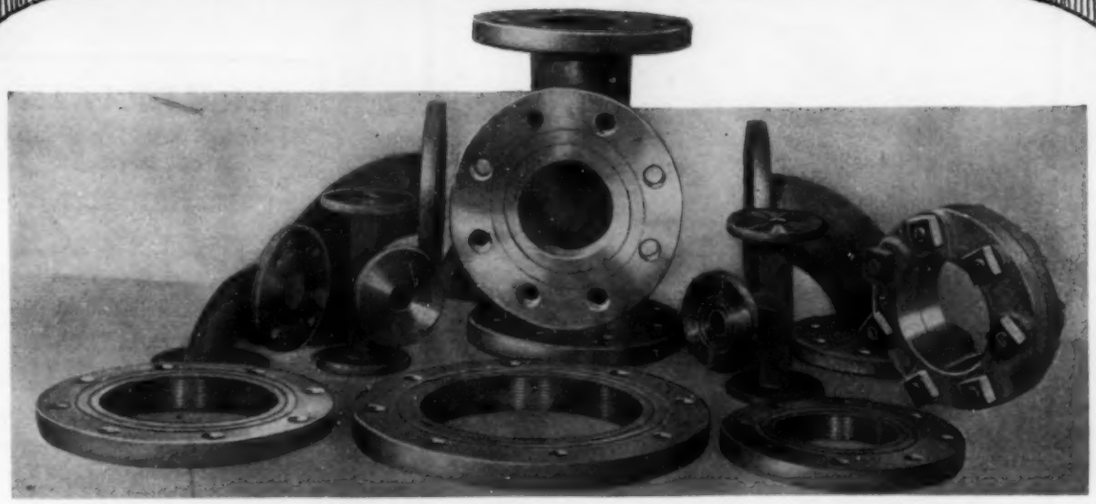
Electromet Brand *Ferro-Alloys and Metals*

Sole Distributors

ELECTRO METALLURGICAL SALES CORPORATION

Unit of Union Carbide and Carbon Corporation
Carbide and Carbon Building, 30 E. 42d St., New York

BRONZES
ACID RESISTING



We make process fittings (Flanged or Screwed) of special acid-resisting Bronze and non-ferrous alloys best suited to various acid requirements. A few of these fittings are shown above.

No One Alloy Answers!

Every acid condition demands different metallic structure to combat it. A single alloy can never have a universal application.

Therefore, *you are not limited to one* acid-resisting metal when you use American Manganese Bronze products.

We make:

Autoclaves	Mixing kettles
Airlifts	Pickling crates and barrels
Circulating devices	Rolls
Converter sections	Valves, pipe fittings and
Jacketed pots	other equipment

--and we make them according to *your* needs, of alloys best employed for your particular problem of temperature, corrosive agents, pressure, etc.

We can also furnish Sheets, Rods and Forgings of our own metals; and we have facilities for designing, machining and fabricating apparatus such as listed herewith, *so as to supply exactly what you require.*

Send for Literature on acid-resisting Bronzes

AMERICAN MANGANESE BRONZE CO.

Founders and Metallurgical Engineers

HOLMESBURG — PHILADELPHIA

Pittsburgh Cleveland New Orleans New York

GOLF CLUB HEADS · LUBRICATOR BODIES · HARDWARE SPECIALTIES · WASHING MACHINES · STUDS · DUPLICATING MACHINES · KICK PLATES · WEDGES · STEEL FENCE PARTS · LOCK WASHERS · ARMS AND MUNITIONS

PARKERIZING *is* Rust Proofing

NUTS, bolts, washers and screws are in universal use—entering directly or indirectly into the fabrication of every manufactured product. The volume of these essentials now being protected against rust by Parkerizing totals hundreds of tons daily.

Rust is an insidious enemy in the home as well as in the factory—wherever iron or steel is used. Rust is no longer inevitable. Today leading manufacturers in every line of industry are finding in Parkerizing an effective protection from corrosion.

The Parker Process is available to any manufacturer who will install the few simple tanks required, or at any of the Parkerizing Jobber Service Plants.

Parkerizing is accomplished by immersing cleaned iron or steel articles in a solution of hot water and "Parco Powder," a clean, dry chemical of concentrated rust-proofing energy, producing adequate results at low cost.

Send for your copy of "The Parker Process"

PARKER RUST-PROOF CO.
2178 EAST MILWAUKEE AVENUE
DETROIT, MICHIGAN

PARKER PROCESS

PARKERIZING
Jobber Service Plants

BALTIMORE, MD.
Federal Tin Company, Inc,
Parkerizing Dept., Charles and Barre Sts.

BUFFALO, N. Y.
Parker Rust-Proof Co. of Buffalo, Inc.
460 East Eagle St.

BOSTON, MASS.
Rust-Proofing & Metal Finishing Corp.,
Commercial Ave. & Binney St.,
Cambridge C.

CLEVELAND, O.
Parker Rust-Proof Co. of Cleveland
2617 E. 76th St.

CANTON, OHIO
G. C. Reiter

CINCINNATI, OHIO
The Stolle Corporation
227-241 W. McMicken

CHICAGO, ILL.
Western Rust-Proof Co.,
2139 Walnut St.

DETROIT, MICH.
2177 East Milwaukee Ave.

DAYTON, OHIO
Dayton Rust-Proofing Co.,
736 N. Main St.

EVANSVILLE, IND.
Evansville Plating Works

INDIANAPOLIS, IND.
Parker Rust-Proof Co. of Indiana, Inc.
820 N. New Jersey St.

KANSAS CITY, KANSAS
Parker Rust-Proof Co. of Missouri,
1215 Southwest Blvd.

LOS ANGELES, CALIF.
Parker Rust-Proof Co. of Los Angeles,
2500 East 23rd St.

LOUISVILLE, KY.
Republic Welding Co., Inc.,
305 College St.

MILWAUKEE, WIS.
Badger Manufacturing Corp.,
Mitchell Ave., West Allis

NEW YORK
Pyrene Manufacturing Co.,
560 Belmont Ave., Newark, N. J.

PHILADELPHIA, PA.
Philadelphia Rust-Proof Co.,
109 West Montgomery Ave.

PUEBLO, COLO.
Colorado Culvert & Flume Co.

PITTSBURGH, PA.
Pittsburgh Electro Galvanizing Co.
5th St. and Penna R. R., Sharpsburg

SAN FRANCISCO, CALIF.
Best & Company,
2005 Clement Ave., Alameda

ST. LOUIS, MO.
St. Louis Rust-Proof Co.,
514-516 S. Broadway.

TORONTO, ONT.
Fairgrieve & Son,
50 Dovercourt Road

TOLEDO, OHIO
Jas. E. Nagle & Sons,
3835 Alexis Ave.

TORRINGTON, CONN.
Turner & Seymour Company,
Parkerizing Department.

WAYNESBORO, PA.
Landis Engineering & Mfg. Co., Inc.

Pure Iron Prolongs Life of Glue Cookers

GLUE making...with its long sustained heat and pungent corrosives...A hazardous assignment for any sheet or plate equipment.

Yet ARMCO Ingot Iron proves worthy of the task. At the C. E. Francis Glue Company, Rushville, Indiana, the glue cookers shown above have rendered long, satisfactory service ...more so than any metal this company has ever used.

Considering its long life you will be agreeably surprised at the low initial cost of this pure iron. It saves as it serves.

The office nearest you will gladly investigate your particular corrosion problem. Your request brings an experienced engineer to the scene.

THE AMERICAN ROLLING MILL COMPANY
Executive Offices, Middletown, Ohio
Export: The ARMCO International Corporation
Cable Address: ARMCO, Middletown, (O.)

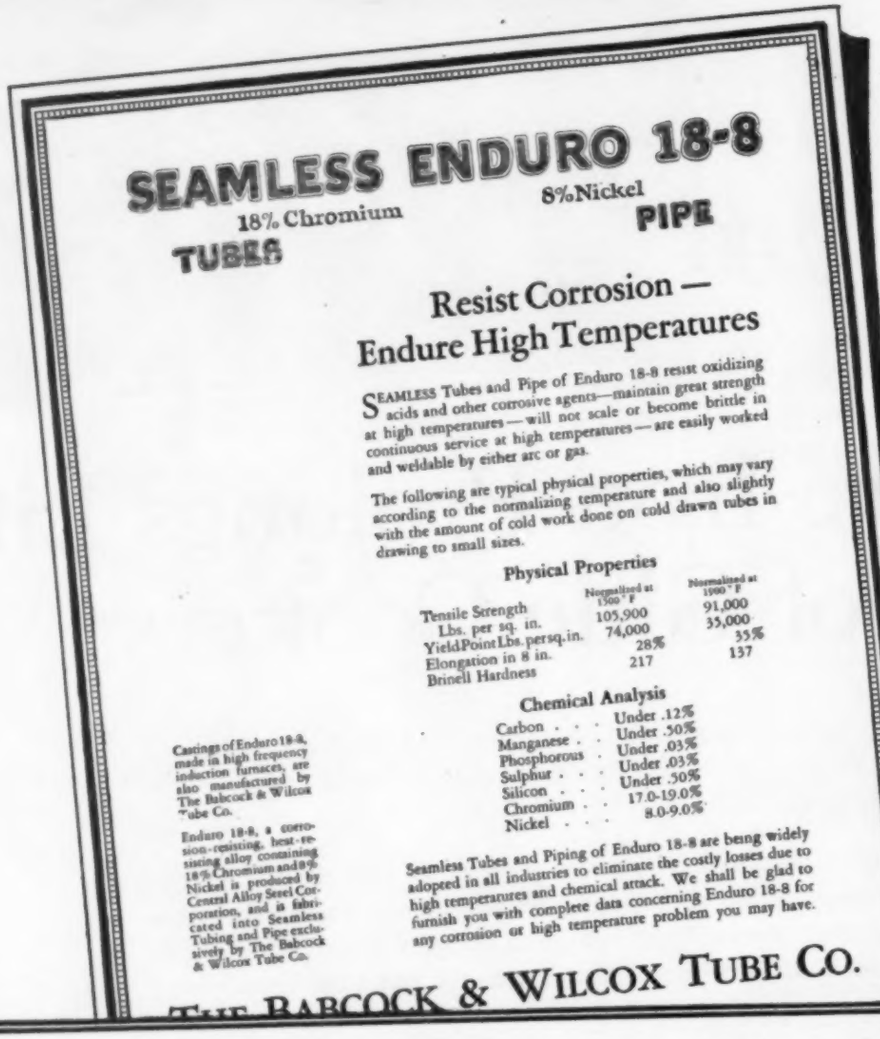
DISTRICT OFFICES

Chicago	Detroit	San Francisco
Cincinnati	New York	Pittsburgh
Cleveland	Philadelphia	St. Louis

Lasts Longer

ARMCO
INGOT IRON
RESISTS RUST

Costs Less


SEAMLESS ENDURO 18-8
18% Chromium
8% Nickel
TUBES
PIPE
Resist Corrosion —
Endure High Temperatures
SEAMLESS Tubes and Pipe of Enduro 18-8 resist oxidizing acids and other corrosive agents—maintain great strength at high temperatures — will not scale or become brittle in continuous service at high temperatures — are easily worked and weldable by either arc or gas.
The following are typical physical properties, which may vary according to the normalizing temperature and also slightly with the amount of cold work done on cold drawn tubes in drawing to small sizes.
Physical Properties
Tensile Strength Lbs. per sq. in. 105,900 91,000
Yield Point Lbs. per sq. in. 74,000 35,000
Elongation in 8 in. 28% 35%
Brinell Hardness 217 137
Chemical Analysis
Carbon Under .12%
Manganese Under .50%
Phosphorous Under .03%
Sulphur Under .03%
Silicon Under .50%
Chromium 17.0-19.0%
Nickel 8.0-9.0%
Castings of Enduro 18-8, made in high frequency induction furnaces, are also manufactured by The Babcock & Wilcox Tube Co.
Enduro 18-8, a corrosion-resisting, heat-resisting alloy containing 18% Chromium and 8% Nickel is produced by Central Alloy Steel Corporation, and is fabricated into Seamless Tubing and Pipe exclusively by The Babcock & Wilcox Tube Co.
Seamless Tubes and Piping of Enduro 18-8 are being widely adopted in all industries to eliminate the costly losses due to high temperatures and chemical attack. We shall be glad to furnish you with complete data concerning Enduro 18-8 for any corrosion or high temperature problem you may have.
THE BABCOCK & WILCOX TUBE CO.

To Eliminate Costly Losses

B & W Adopt Enduro Stainless Iron

WHAT the Babcock & Wilcox Tube Company think of Agathon Enduro Stainless Iron is expressed in this recent advertisement in Chemical and Metallurgical Engineering. This company has adopted Enduro exclusively for seamless tubes and piping for the chemical industry. Its high degree of resistance to corrosion, to scaling at high temperatures and to the injurious effects of many chemicals is leading to its universal use in chemical plants. Write for complete information.

AGATHON ENDURO STAINLESS

CENTRAL ALLOY STEEL CORPORATION, Massillon, Ohio

World's Largest and Most Highly Specialized Alloy Steel Producers

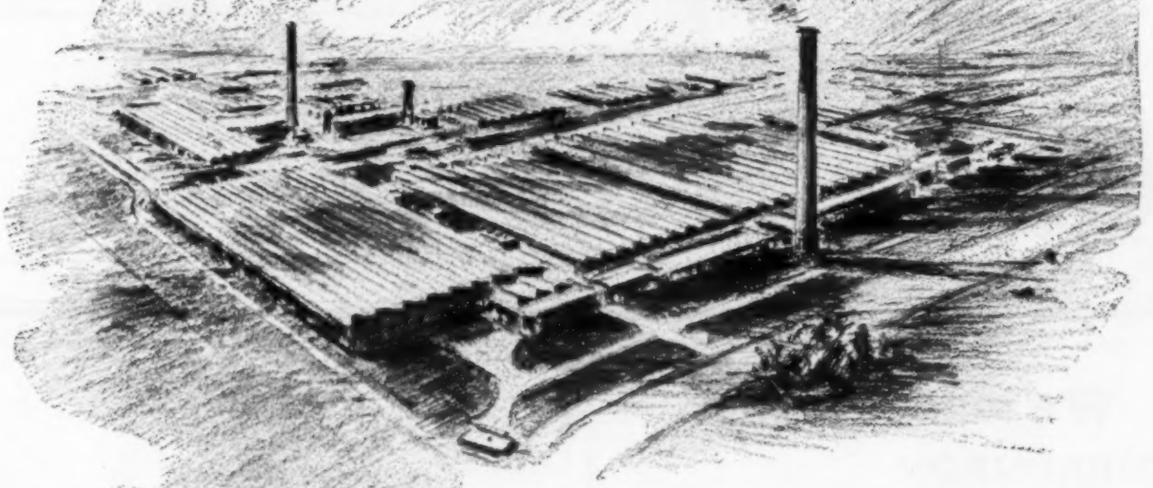
Makers of Toncan Copper Mo-lyb-den-um Iron

Cleveland Syracuse Detroit Chicago New York St. Louis
Seattle San Francisco Philadelphia Los Angeles Cincinnati

THE SPINNERETTE IS THE HEART OF THE RAYON PLANT

In a great steamship, all the complicated mass of boilers, engines and pumps and the labor of the fireroom crew are directed towards a single end—a simple operation in itself—the uninterrupted revolution of the main shaft.

So in a rayon plant everything that goes before leads to a single operation—the forcing of the cellulose solution through the orifices of the spinnerettes. Rayon is not rayon until it has passed through the jets and upon the uniformity of the hole sizes depends the uniformity of the filatures. We are alive to this all-important fact and so we work to a tolerance of 1/10,000th of an inch and closer if need be.



No material has yet been found to replace satisfactorily platinum-gold and palladium-gold for spinnerette making. These alloys are corrosion proof. They are tough. They machine perfectly and they always have a redemption value close to their original cost. Their worth as scrap is not much below the price of new metal. This small difference, plus a low making charge, is all you need consider should a change in the number or arrangement of holes seem advisable. With any other material, your renewal cost will at least equal your first cost. As scrap, it is worthless.

Our long metallurgical experience makes it possible for us to work with you, should you wish to experiment with new precious metal alloys. And we shall be glad to do it. We are proud of the speed with which we make deliveries too and it is our practice to carry a certain stock of cups for each of our customers, so that emergency orders can be filled even more quickly.

If you are contemplating a new plant or an extension of your present one, let us tell you in detail what we can do for you.

BAKER & CO. INC. 54 AUSTIN STREET NEWARK, N.J.

To insure satisfaction . . . use

DURALOY

(The Original Chrome-Iron)

The Duraloy Company *specializes* in the production of heat and corrosion resistant alloys.

It owns and operates its own plant at New Cumberland, W. Va., (Pittsburgh District).

This plant produces only alloys for corrosion and oxidation resistance.

Improved methods of manufacture, frequent additions of modern plant equipment and the advantages of specialization all help to make Duraloy a uniform high grade product.

Castings, bars, sheets, plates, wire, tubes, etc.

27—30% Chrome

16—18% Chrome

ALSO

CHROME-NICKEL ALLOYS

The
DURALOY COMPANY
Pittsburgh, Pa.

To Resist

Nitric acid, hot or cold, in all percentages of concentration; fruit and vegetable acids; sulphur compounds, salt water, acid mine waters, organic acids; heat to 2100 deg. F.

We Manufacture

CORROSIRON
—acid resisting, high silicon cast iron.

FLINTCAST
—resists abrasion, harder than white iron.

PYROCAST
—in casting form—resists heat.

GREY IRON and SPECIAL CASTINGS
—close grained strong cast iron.

NICHOLS-HERRESHOF ROASTING FURNACES
—all manufactured in our plant.

MONEL METAL

Representing International Nickel Co.

Catalog on request.

Pacific Foundry Company
18th and Harrison Sts., SAN FRANCISCO

THERMIT

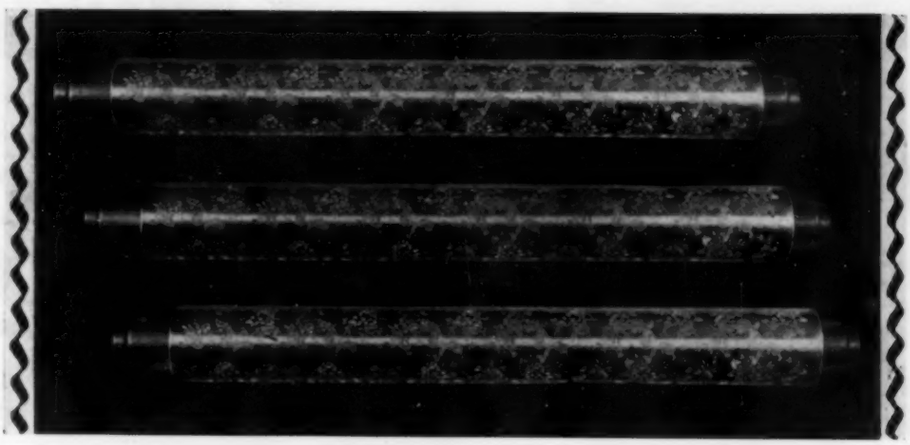
Carbide Free Metals and Alloys

Ferro Titanium.....25% Ti.
Ferro Chromium.....60% Cr.
Ferro Tungsten.....75-80% W.
Ferro Vanadium.....35-40% V.
Pure Manganese....96-98% Mn.
Pure Chromium.....97-98% Cr.

Send for Pamphlet No. 2041

METAL & THERMIT CORPORATION
120 BROADWAY, NEW YORK CITY
Pittsburgh Chicago Toronto Boston S. San Francisco

CHROMIUM PLATING



Costly wear Curbed!

How chromium plate greatly increases the life of wearing parts

BECAUSE it has proved to be a highly effective means of combating wear, chromium plate is being used for this purpose by an ever-increasing number of companies.

For example, textile printers and card and paper companies are chromium plating their heavy, engraved copper and steel printing rolls, such as illustrated above— to reduce wear and avoid frequent costly reengraving.

One company writes, "So far as the life of these chromium plated rolls as compared to the regular steel roll is concerned, we cannot say, for none of them have yet worn out. We can state, however, that in one instance, one of these rolls has been run sufficiently to have worn out an unplated roll at least twice, with practically no signs of wear yet visible."

If you are confronted with a wear or corrosion problem investigate the possibilities of chromium plating. United Chromium, Inc., is organized to render a helpful and valuable service. Because of its many years of experience and research facilities it is in a position to give you sound advice and to cooperate with you fully and effectively.

UNITED CHROMIUM
INCORPORATED
51 East 42nd St., New York City

Send Today for a Sample of Rex

Here is a sheet packing which I first started to manufacture in this country back in 1907. I have improved it to a point where I can now give it my unqualified approval.

It is made of asbestos and other heat-resisting materials and does not become brittle or deteriorate with age. Soft and pliable, it is easy to handle.

It is ideal against extreme pressures and temperatures of steam, hot and cold water, ammonia, etc.

A postal card request marked for my attention will bring a generous sample.

O. J. Garlock

Crandall Packing Co.

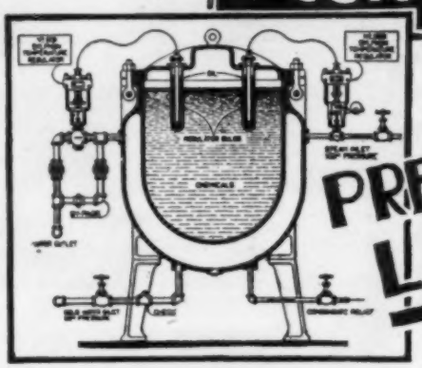
Perfected Packings for Every Purpose

Palmyra, N. Y., Boston, Chicago, Cleveland, Houston, New York, Pittsburgh, Philadelphia, Kansas City, Mo., St. Louis

Sylphon

TRADE MARK

POSITIVE TEMPERATURE CONTROL



PREVENTS LOSS

Saves Expensive Materials and Avoids Fires and Explosions

SYLPHON Automatic Temperature Control places your process on a smooth production basis without interruptions and delays resulting from fluctuating temperatures.

Above is shown the illustration of an installation of a No. 931 Sylphon Temperature Regulator and a No. 938 Sylphon Temperature Limit Valve on a steam jacketed Processing Kettle. The chemical reaction is started by heat about 300 deg. F. from high pressure steam in the jacket. When the reaction starts, the contents rapidly generate their own heat and pressure. To prevent over-heating, it is necessary to turn off the steam and inject cold water into the jacket. The No. 938 controls the steam and cuts off at a pre-determined temperature and a reverse acting No. 931 in the water outlet prevents a further rise in temperature by controlling the circulation of cooling water in the jacket.

The No. 931 Sylphon Regulator

Spring Type for Controlling Temperature of Liquids

Has double-seated balanced valve suitable for high or low pressures. Made in valve sizes ½ in. to 2½ in., inclusive.

Owing to its compactness, and the fact that it can be installed in any position, it is largely used in industrial processes, where one definite temperature is required from day to day.

Sylphon Temperature Regulating Instruments are meeting all requirements in hundreds of plants. We invite correspondence. Detailed drawings supplied on all specific applications. Send for Bulletin ET-108.

Representatives in all Principal Cities in U. S. A.
European Representatives, Crosby Valve & Engr. Company, Ltd., 41-2 Foley St., London, W. 1, England.
Canadian Representatives, Darling Bros. Ltd., 140 Prince St., Montreal, Que., Canada

THE FULTON SYLPHON COMPANY

KNOXVILLE, TENNESSEE

Mason Regulators used at Ivorydale

Tremendous quantities of steam are used in the manufacture of soap; exact pressures must be maintained or the quality of the products will be lowered. Procter & Gamble use Mason Regulators extensively throughout their plant for the accurate control of reduced pressures. They give constant, dependable service without requiring a lot of attention and their accuracy does not diminish with long, steady use.

Tests more severe than any imposed during actual service are given each regulator before it leaves the factory and experienced engineers know that Mason Regulators will relieve them of the worry and responsibility for accurate pressure control . . . save steam and help to reduce costs. You will find it profitable to use them in your plant. Write for a copy of Catalog No. 62.

Mason Regulators

MASON REGULATOR CO.
Boston, Mass.

San Francisco Office: 606 Howard Street

Mason Regulator Company of Canada, Ltd., 686 Notre Dame Street West, Montreal

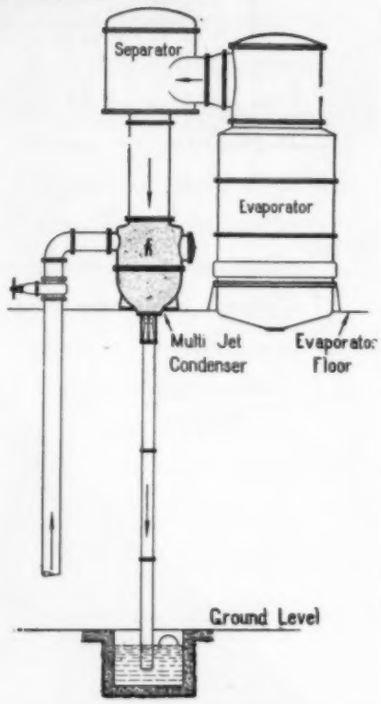
1923

BAROMETRIC MULTI-JET CONDENSERS
operate without air pumps

The water jets produce the vacuum by condensing the steam and maintain the vacuum by entraining the air and gases.

30 standard sizes—Vapor inlets 12 in. to 66 in.

Bulletin 5-AA (just published) contains interesting data. Send for a copy.



Specify S & K Barometrics
for evaporators and vacuum pans

The S & K line also includes jets, valves, spray nozzles, heaters, coolers, oil burners, gear pumps, etc., for the chemical industry.

SCHUTTE KOERTING
1190 Thompson St., Philadelphia, Pa.

THE BABCOCK & WILCOX COMPANY
85 LIBERTY STREET, NEW YORK

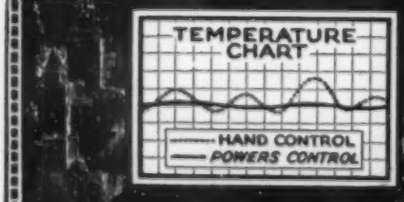
Builders since 1868 of Water Tube Boilers of continuing reliability

BRANCH OFFICES
ATLANTA, Candler Building
BOSTON, 80 Federal Street
CHICAGO, Marquette Building
CINCINNATI, Traction Building
CLEVELAND, Guardian Building
DALLAS, TEXAS, Magnolia Building
DENVER 444 Seventeenth Street
DETROIT, Ford Building
HOUSTON, TEXAS, Electric Building
LOS ANGELES, Central Building

WORKS
Bayonne, N. J.
Barberton, Ohio

Makers of Steam Superheaters since 1898 and of Chain Grate Stokers since 1893

BRANCH OFFICES
NEW ORLEANS, 344 Camp Street
PHILADELPHIA, Packard Building
PHOENIX, ARIZ., Heard Building
PITTSBURGH, Farmers Deposit Bank Building
PORTLAND, ORE., Failing Building
SALT LAKE CITY, Kearns Building
SAN FRANCISCO, Sheldon Building
SEATTLE, L. C. Smith Building
HONOLULU, T. H., Castle & Cooke Building
HAVANA, CUBA, Calle de Aguiar 104
SAN JUAN, PORTO RICO, Recinto Sur 51



35 Years of Specialization in Temperature Control

SYSTEMS of Temperature Control for Offices, Workrooms, and Process Rooms. ¶ Regulators to control the temperature of Liquids, Gases, and Air in Industrial Processes. ¶ Thermostatic Regulators to control the mixing of Hot and Cold Air, Hot and Cold Water, Steam and Cold Water, to deliver a mixture at any temperature desired. ¶ High Pressure Steam Traps. ¶ Dial Indicating Thermometers.
Write for Bulletins

2727 Greenview Ave., Chicago. Also New York, Boston, Toronto, and 31 other offices. See your telephone directory
(G-3430-A)

The POWERS REGULATOR COMPANY

The Pipe Line Tracyfier

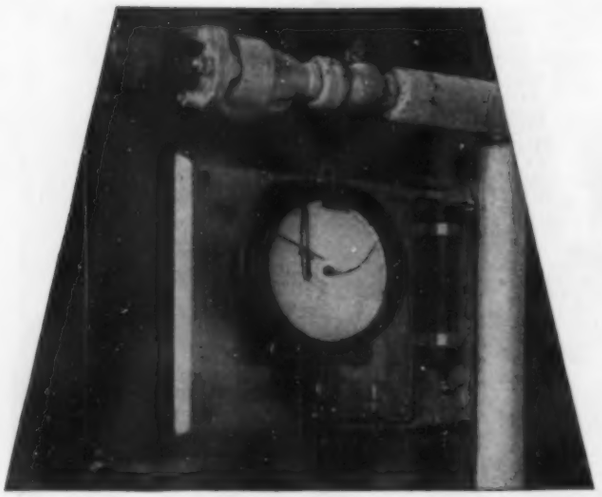
USES SAME PRINCIPLES AS THE TRACYFIER

Guaranteed to deliver Standard Specification Steam. Note illustration showing baffles. (Do not confuse this precision-built instrument with ordinary separators or strainers.) Use it to obtain clean, dry steam to turbines, dryers, filters, burners, pumps, dye vats, etc.; clean, dry air to air tools, hoists, molding machines, etc. Can be furnished for any quantity or pressure of steam, air, gas, or vapor; any size pipe lines.

Write for new Bulletin No. 1047.

ANDREWS-BRADSHAW DIVISION
BLAW-KNOX COMPANY
690 Farmers Bank Bldg., Pittsburgh, Pa.
Offices and Representatives in all principal cities

TRACYFIER
THE STEAM PURIFIER



SPEED UP DRYING with FOXBORO CONTROL

THOUSANDS of manufacturers have speeded up drying by installing Foxboro Automatic Recorder-Controllers for controlling temperature or humidity. This has been accomplished with perfect safety—without sacrificing quality. In most cases the quality of the finished product has been improved.

The Trenton Potteries Company at Trenton, N. J., installed Foxboro Humidity Recorder-Controllers on their dryers three years ago. These instruments have made possible enormous savings in terms of money, labor and increased production.

Foxboro Controllers are air-actuated. This means absolutely positive action. A Foxboro Controller operates on a quarter of one degree temperature variation. It makes an accurate and continuous record of the entire process. These records are invaluable for future reference. Each instrument is guaranteed as only the highest type of instrument can be. You take no risk.

Write to the nearest Foxboro Branch Office for complete information.

THE FOXBORO COMPANY

Neponset Avenue, Foxboro, Mass., U. S. A.

NEW YORK · CHICAGO · BOSTON · DETROIT
PHILADELPHIA · PITTSBURGH · CLEVELAND · TULSA
ROCHESTER, N.Y. · ATLANTA · LOS ANGELES · DALLAS
PORTLAND, ORE. · SAN FRANCISCO

Peacock Brothers, Limited
1605 Delorimier Ave.
Montreal, Canada

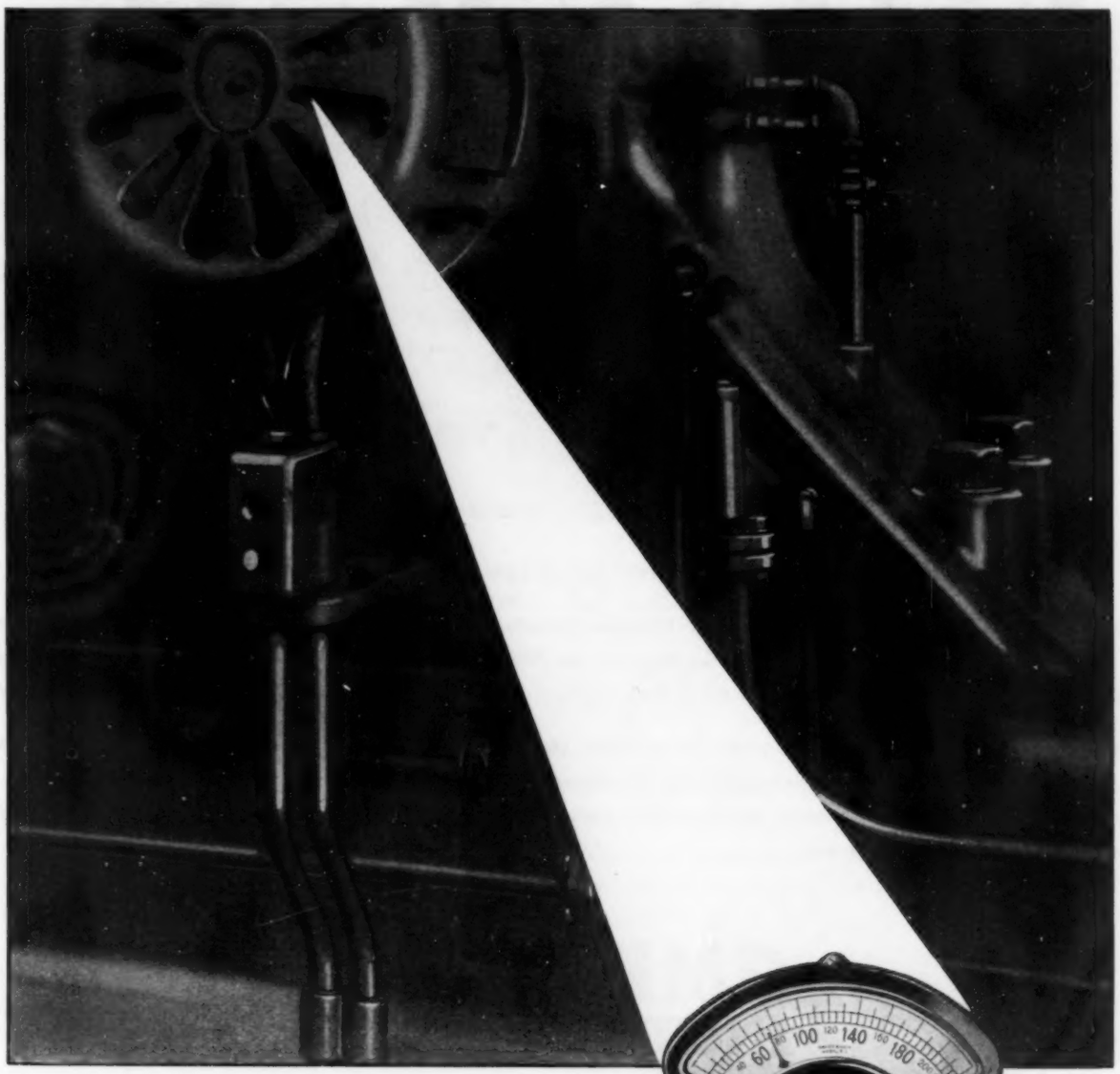
Sole British Representatives:
Walker-Crosweller & Co.
58 Queen Elizabeth Street
London, S. E.

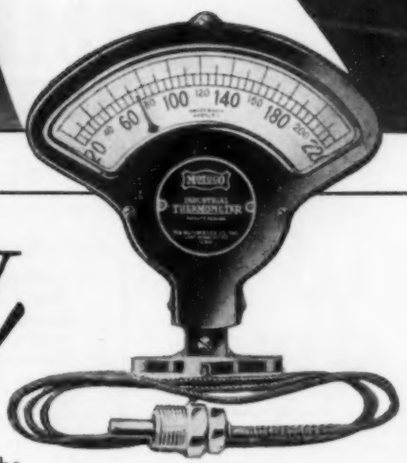
Telechron

Foxboro Recording and Controlling Instruments can be furnished with the Telechron Motor, which insures maximum accuracy of time, perfectly synchronized records, and which eliminates all winding, oiling, regulating and cleaning. Simply change the charts.

FOXBORO
REG. U. S. PAT. OFF.
THE COMPASS OF INDUSTRY

INSTRUMENTS *for* CONTROLLING, RECORDING *and* INDICATING TEMPERATURE, FLOW, HUMIDITY *and* PRESSURE





The hidden story . . . *Revealed!*

BEARINGS on heavy duty machinery *must* run cool. If they do not the consequences are not pleasant to imagine.

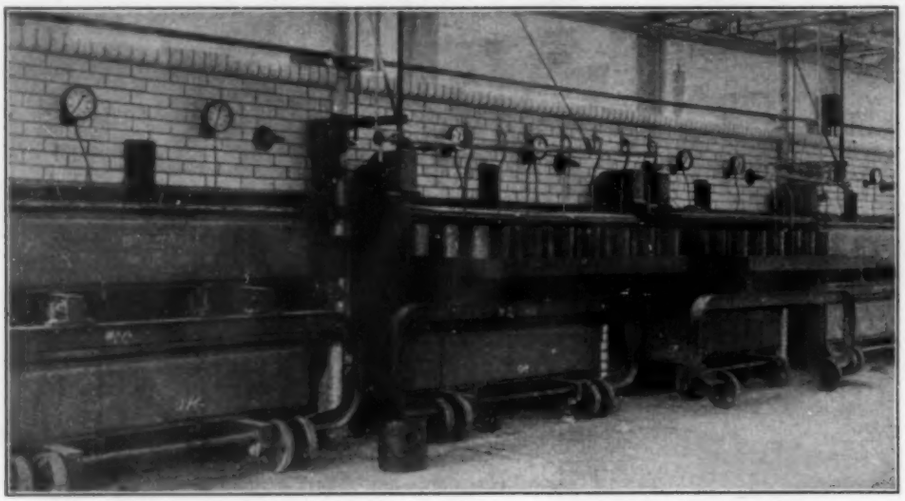
Happily there is a low-cost, faithful, efficient guardian available to tell you at all times the hidden story of temperature . . . to bring the temperature to you from any place that is hard to get at . . . The Motoco Industrial Thermometer.

Motoco has earned its place on five counts: Accuracy, dependability, convenience, ease-of-reading, and low-cost. Check these points against your need for temperature knowledge, and you will find Motoco the logical selection. To assist you, may we send Catalog?

THE MOTOMETER COMPANY, INC.
8 Wilbur Avenue, Long Island City, N.Y.
The MotoMeter Co. of Canada, Ltd., Hamilton, Ont.
For industrial gauges consult our subsidiary, National Gauge & Equipment Co., La Crosse, Wisconsin

MOTOCO
Industrial Thermometers
may be obtained in various ranges between Minus 40°F and Plus 750°F.

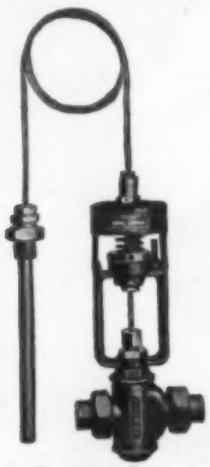
INVESTMENTS—



MAINTAINING UNIFORM QUALITY AT HIGH PRODUCTION

When Boston Beans are baked by Friend Brothers in Melrose, Mass., the correct baking temperature is always known. The American Dial Thermometers over each oven keep this temperature within the sight of the operator constantly. He has absolute control all the time.

Then when processing the beans in retorts, the temperature is automatically regulated by American Temperature Controllers. Nothing is left to chance. With these instruments it is possible to maintain high production and be assured of uniform quality. And it can't be done without instruments.



American Precision Temperature-Controller. Simple. Rugged. Self-Operated. Accurate. With favorable conditions, regulation within 1°F will be maintained constantly.

AMERICAN INSTRUMENTS

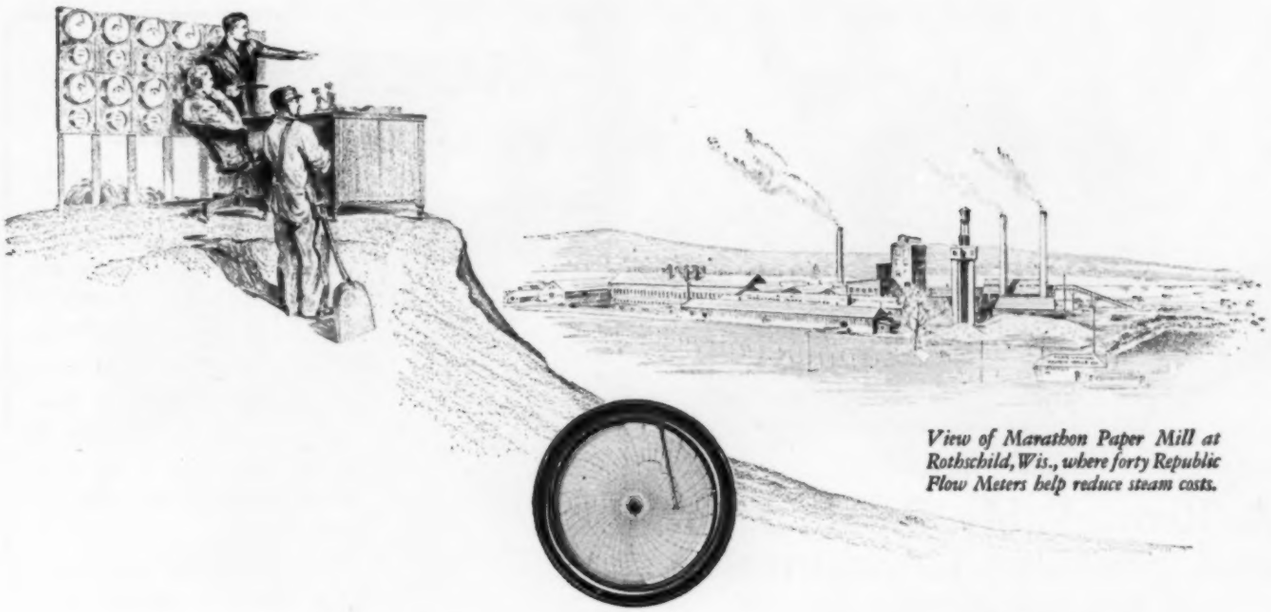
SINCE 1851

Specify Catalogs Desired

Indicating Gauges	A-4
Recording Gauges	E-4
Gauge Testers	D-4
Safety & Relief Valves	U-4
Tachometers	K-4
Glass Thermometers	F-4
Dial Thermometers	G-4
Recording Thermometers	H-4
Temperature Controllers	R-4

American Dial Thermometer is Mercury Actuated and guaranteed accurate to within 1% of scale range. For any temperature range from —40 to 1000°F. Made with 6" dial and with connecting tubing up to 80 ft.

CONSOLIDATED ASHCROFT HANCOCK CO. INC.
AMERICAN SCHAEFFER & BUDENBERG DIVISION
338 Berry Street Brooklyn. N.Y.
Branches in Principal Cities



View of Marathon Paper Mill at Rothschild, Wis., where forty Republic Flow Meters help reduce steam costs.

Come Up on the Hill *with* Republic

GOOD management is a continual war on waste. The successful operation of any plant is dependent upon the economical operation of all departments. Economies in one particular phase of operation are not sufficient to assure the profitable operation of the entire plant.

You have cut your costs on steam production—does this same economy follow through to the various processes using the steam—or does economy end with the boiler room?

Someone must have a hill-top view of the entire field of activity. Someone must co-ordinate the efforts of all departments. Flow meters will provide you with a complete check on the operation of each department. They will provide a complete and accurate record of the generation, distribution and utilization of power in your plant.

Bulletin "Steam Economy" mailed on request

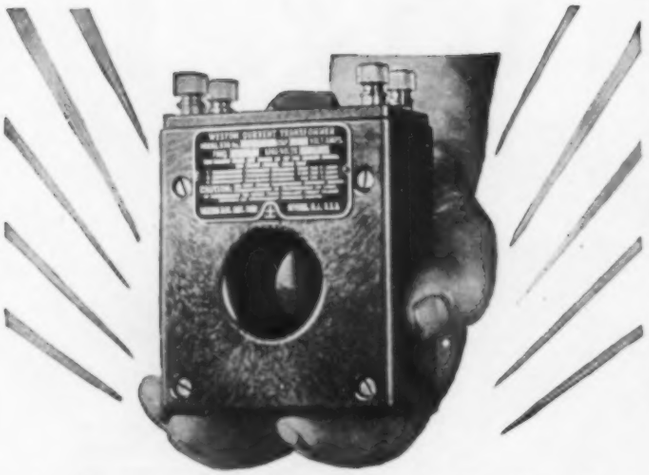
REPUBLIC FLOW METERS COMPANY

Executive Offices and Plant · Diversey Parkway · Chicago, Ill.

Branch Offices in 25 Principal Cities

DOMINION FLOW METERS CO., *Toronto, Canada* ELEKTROFLO, *Berlin, Germany* ELECTROFLO METERS CO., *London, England*

REPUBLIC FLOW METERS



A Remarkably Small, Light and Efficient Combination

for A. C. Current Measurements
0.2 to 200 Amperes

IN the Model 539 Current Transformer, and its companion instrument the Model 528 A. C. Ammeter, Weston has made a most useful and noteworthy contribution to the art of electrical measurement.

These instruments are handsomely encased in mottled red and black bakelite, and every feature of design and construction is fully in keeping with highest Weston standards. The miniature size and low cost of this equipment make it especially attractive for service where extreme accuracy is not of prime importance and where the expense of major instruments would be prohibitive.

Moreover, it permits of measuring currents under one ampere which is not possible with transformers having five-ampere secondaries. Yet its testing range is sufficiently high to satisfy the great majority of current measuring requirements.

These instruments are useful as auxiliary equipment for central stations; for installing and servicing household appliances; for industrial plants in testing small motors and other electrical equipment; for electrical manufacturers in checking their products; and for numerous other uses met with in the railway, mining, and engineering fields, electrical repair shops, laboratories and educational institutions.

Write now for descriptive literature — of value to every business executive and engineer who is interested in the subject of electrical testing.

Summary of Transformer Characteristics:

Ranges: self-contained—2, 5, 10, 20 amperes; inserted primary—50, 100, 200 amperes. Secondary, one ampere. Secondary burden, 2 volt-amperes maximum. Accuracy, 1% from 25 to 150 cycles. Weight, 2-⅝ lbs. Self-contained ranges are changed by means of a unique range-changing switch—fool proof, positive and easy of operation.

WESTON ELECTRICAL INSTRUMENT CORP.
590 Frelinghuysen Ave. Newark, N. J.

Weston
PIONEERS SINCE 1888
INSTRUMENTS

ROCKWELL

Air-Tight Blast Gates

for every purpose

Threaded Connections

Threaded Connections
Rack and Pinion
Operating Mechanism

Flanged Connections
Hand Lever
Operating Mechanism

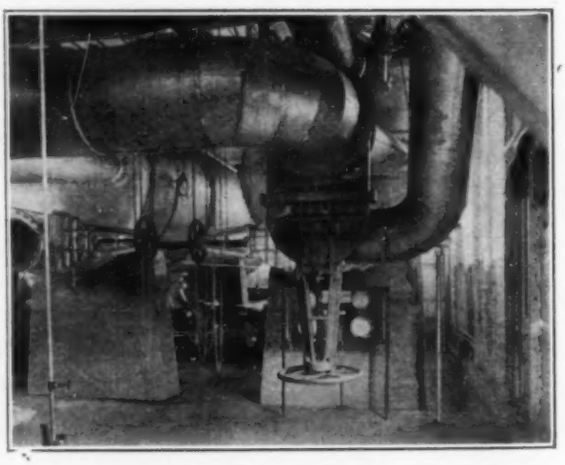
Strong, Compact and Quick Acting—these blast gates are ideally suited to a wide range of control operations, including low pressure air, gases, etc.

Rockwell Air-tight Blast Gates provide the full area of the line. Accurate and positive control assured because the slide "stays put."

Low initial cost plus ability to withstand the abuse of years of hard service, make Rockwell Air-Tight Blast Gates economical control units.

Write for Bulletin 282-E

W. S. ROCKWELL CO.
Industrial Heating Equipment
50 Church St., New York
(Hudson Terminal Bldg.)
Detroit Chicago Montreal

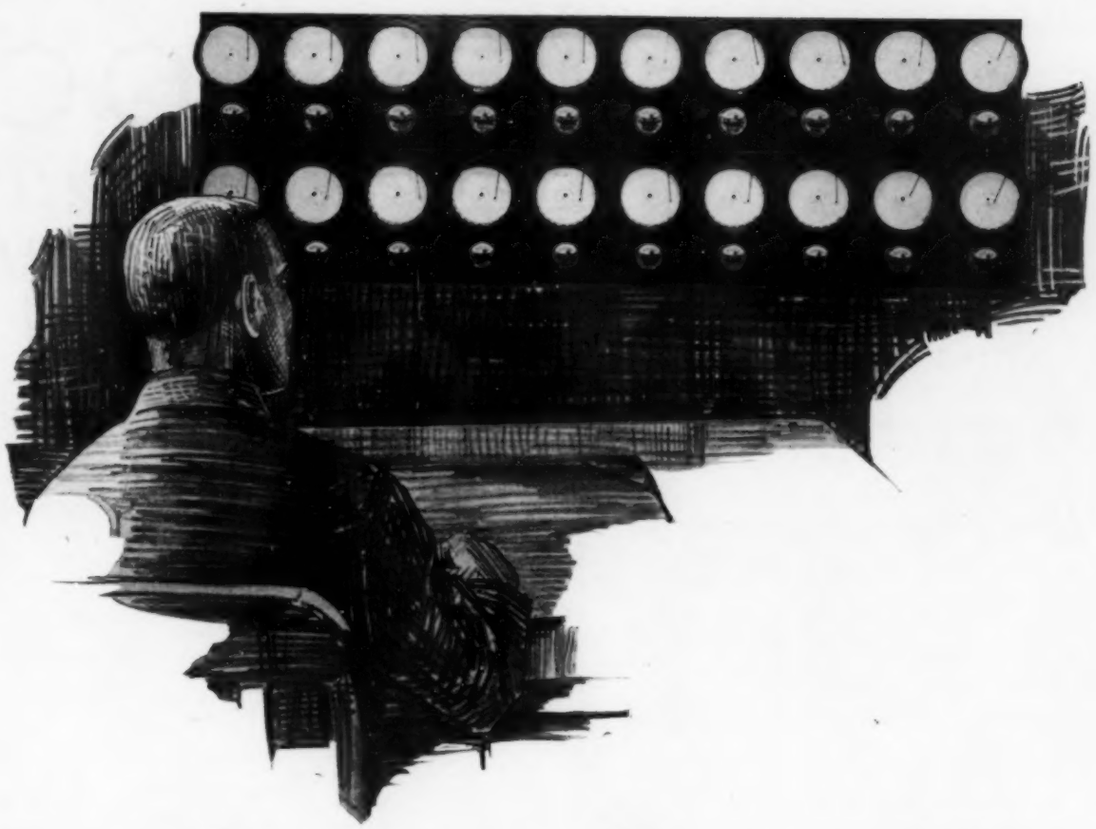


Installations Count!

¶ View of two American Solvent Recovery adsorbers and connections in plant of Athol Mfg. Co., Athol, Mass., artificial leather manufacturers. These units recover 800 gal. of solvents daily from an exhaust of 12,000 cu.ft. of air per minute.

¶ Do you have a solvent recovery problem? May we cooperate in designing the most suitable plant to meet your peculiar conditions?

AMERICAN SOLVENT RECOVERY CO.
COLUMBUS, OHIO



Bailey Electrically Operated Meters

in a Large Paper Mill

The largest and most important industrial power plants throughout the country use Bailey Equipment to insure economical and efficient production and distribution of steam. Continuous daily Boiler Meter and Fluid Meter records result in increased furnace and boiler efficiency, more economical utilization of process steam, detection of leakage losses and the provision of accurate steam consumption data for the cost department.

In one plant 40.7 per cent of the total steam generated was unaccounted for before meters were installed. After installing meters 8.4 per cent was unaccounted for. The installation of meters in this plant reduced the losses and increased efficiency so that the total reduction in steam generating costs was 42 per cent. Surplus boilers were discarded, the labor was reduced from 38 to 16 men and the boiler efficiency was increased from 62.5 to 79.0 per cent enabling the meters to pay for themselves several times over in a year's time.

Write for Bulletins 34, 43 and 131

BAILEY METER CO.,
1054 IVANHOE RD. CLEVELAND, O.
Bailey Meter Company Ltd.–Montreal, Canada

INDUSTRIAL ASSOCIATES
SPRAY DRYERS

Enter New Fields

THE drying of organic glues can be economically done by spray drying.

Centrifugal Spray Machine will atomize viscous and sticky liquids with remarkable success.

Solutions or mixtures of solids with water are sprayed in a heated chamber. The water is instantly evaporated and the solids collected from the bottom of the chamber and from the exit gases.

High yield and high fuel economy are obtained—as high as 12 lbs. of water evaporated per pound of fuel.

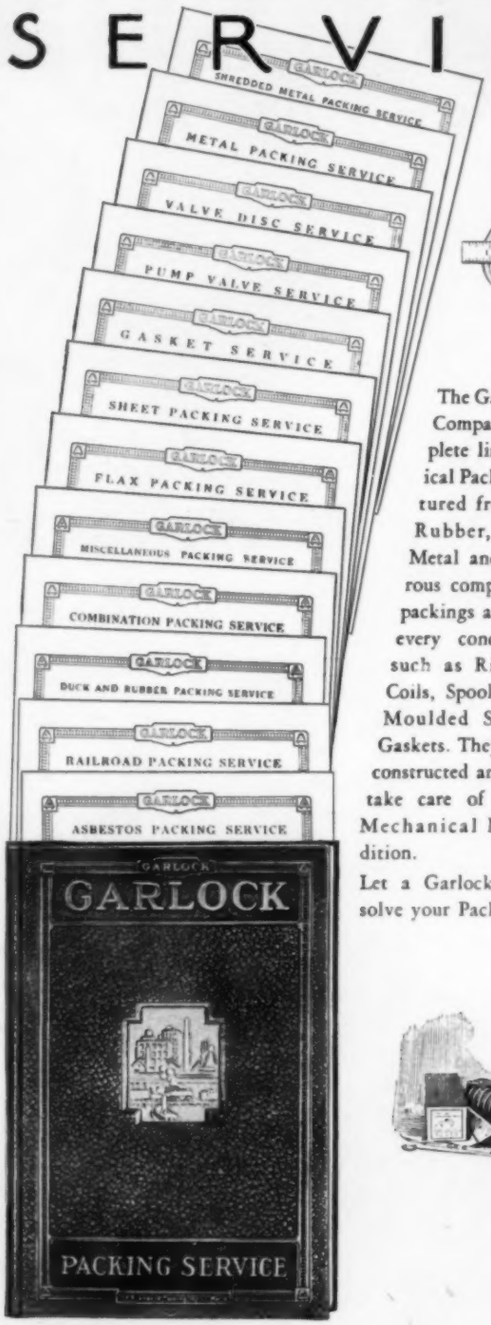
Our Engineers are ready to assist in solving your particular problem. Among the materials we have dried are:

Milk	Sodium-Sulphate
Casein	Sodium Silicate
Blood	Ammonium Phosphate
Garbage	Calcium Phosphate
Sewage Sludge	Lithopone
Sodium Rosinate	Ammonium Sulphate
Soap	Copper Carbonate
Glue	Benzoate of Soda

Write for details of our Patented Process

INDUSTRIAL ASSOCIATES
INCORPORATED
101 Park Ave., New York City

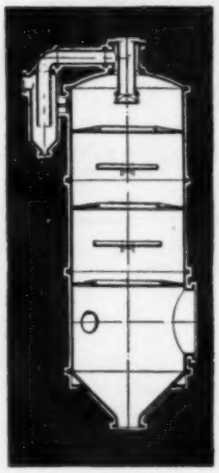
GARLOCK
Sells Complete Mechanical
PACKING
SERVICE



The Garlock Packing Company sells a complete line of Mechanical Packings manufactured from Asbestos, Rubber, Duck, Flax, Metal and various Fibrous compounds. These packings are produced in every conceivable form, such as Rings, Spirals, Coils, Spools, Reels, Sets, Moulded Specialties and Gaskets. They are designed, constructed and processed to take care of any existing Mechanical Packing condition.

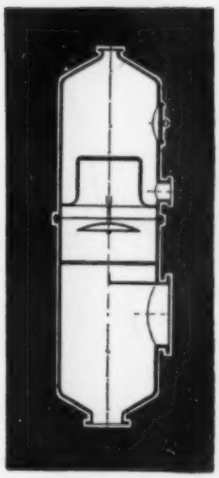
Let a Garlock Service Man solve your Packing Problems.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK
CANADIAN GENERAL OFFICES, MONTREAL QUEBEC.

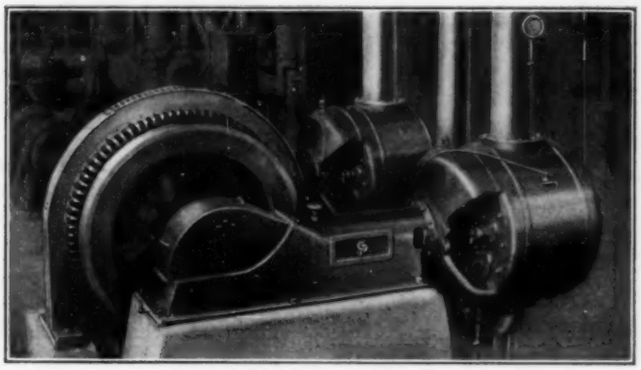


Incorrect water distribution in sugar factory condenser, generally used. 25 feet high. Multiplicity of baffles.

Progress in Vacuum Production Reduces Your Investment



Correct water distribution, Chicago-Byer Condenser, 15 feet high. One baffle.



THE patented design of the Chicago-Byer Barometric Condenser materially reduces the fixed charges on vacuum for the needs of the Process Industries.

The recognized old faults of barometric condensers have been eliminated, as proved by many representative installations.

The Chicago-Byer cools the non-condensible gases leaving at top to a point much lower than was previously thought possible. It is more efficient as a cooling and condensing medium.

All barometrics have been reasonable in maintenance costs, but because the Chicago-Byer has a much larger **SAFE** condensing capacity than any other of equal diameter or cubic capacity, its first cost is also lower.

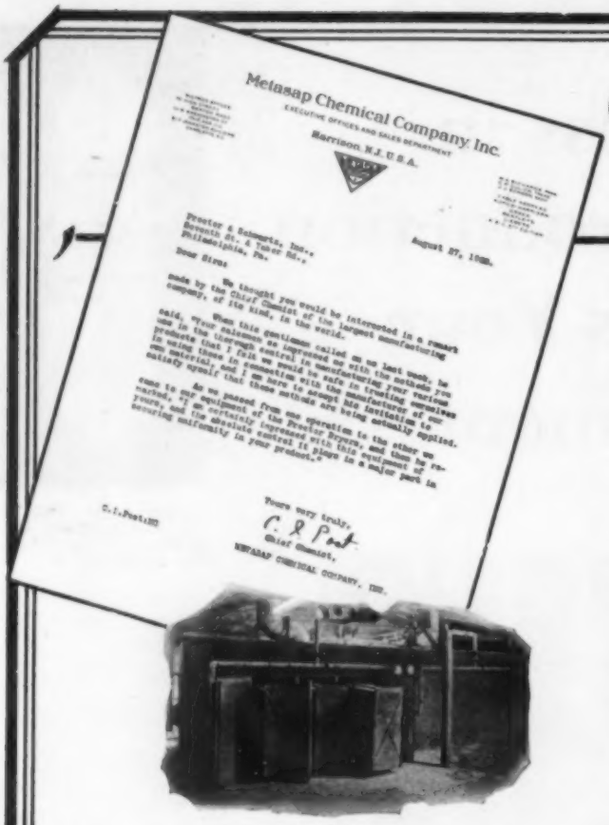
The Chicago-Byer is practical for all vacuum problems in the Process Industries. Write for Bulletin No. 717.

Chicago Pneumatic Tool Co.

Sales and Service Branches all over the world

CV-29

6 East 44th Street New York, N. Y.


Metasap Chemical Company, Inc.
Harrison, N.J. U.S.A.

August 27, 1928.

Proctor & Schwartz, Inc.,
Seventh St. & Tacony St.,
Philadelphia, Pa.

Dear Sirs

We thought you would be interested in a remark made by the Chief Chemist of the largest manufacturing company, of its kind, in the world.

When this gentleman called on us last week, he said, "Your salesmen certainly impressed me with the methods you use in the uniformity control of your various products. I am so impressed, in fact, that I am writing you a letter to that effect."

I am sending it to you because I feel we would be remiss in our duty to you if we failed to co-operate with the manufacturer of our material, and I am happy to say that the manufacturer appreciates fully what these methods are being actually applied.

As we passed from one operation to the other we came to our equipment of the Proctor Dryers, and then he remarked, "I am certainly impressed with this equipment of yours, and the absolute control it plays in a major part in securing uniformity in your product."

Yours very truly,
C. L. Post
Chief Chemist,
METASAP CHEMICAL COMPANY, INC.

C.L.Post:ED

Control in Drying— Uniformity in Product

THE Metasap Chemical Company impresses its customers as being unusually thorough in its methods of controlling the uniformity of its product.

On visiting this plant and viewing Proctor Dryers at work there, the chief chemist of the largest manufacturing company of its kind in the world said:

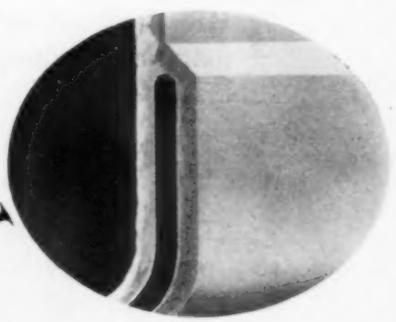
"I am certainly impressed with this equipment of yours (Proctor Dryers) and the absolute control it plays in a major part in securing uniformity in your product."

In passing this testimonial on to us—and to you—the Metasap Chemical Company adds its indorsement to a fact quite generally known throughout process industries—

Proctor Dryers are a factor of certainty in manufacture as well as the efficient means of drying.

PROCTOR & SCHWARTZ, INC.
PHILADELPHIA

After Comparison Your Choice Should be "Frederking"



"Original Frederking" Construction

High velocity of heating or cooling medium.

Steel tubes cast in the walls; cannot crack or leak.

Multiple circuits of heating or cooling medium, producing temperature uniformity.

High effectiveness of heat transfer.

Velocity of cooling medium exceeds critical velocity, and variation of same gives wide range in total heat capacity.

Jacketed Construction

Low velocity of heating or cooling medium.

All cast structure; subject to cracks and leaks.

Single circuit of heating or cooling medium, tending to produce hot spots and cold spots.

Poor effectiveness of heat transfer.

Velocity of cooling medium cannot, in practice, reach critical velocity, hence the heat capacity remains almost constant.

Try "Original Frederking" for Your Next Reaction Vessel

BUILT IN U. S. A. BY

BETHLEHEM FOUNDRY & MACHINE COMPANY
BETHLEHEM, PENNSYLVANIA

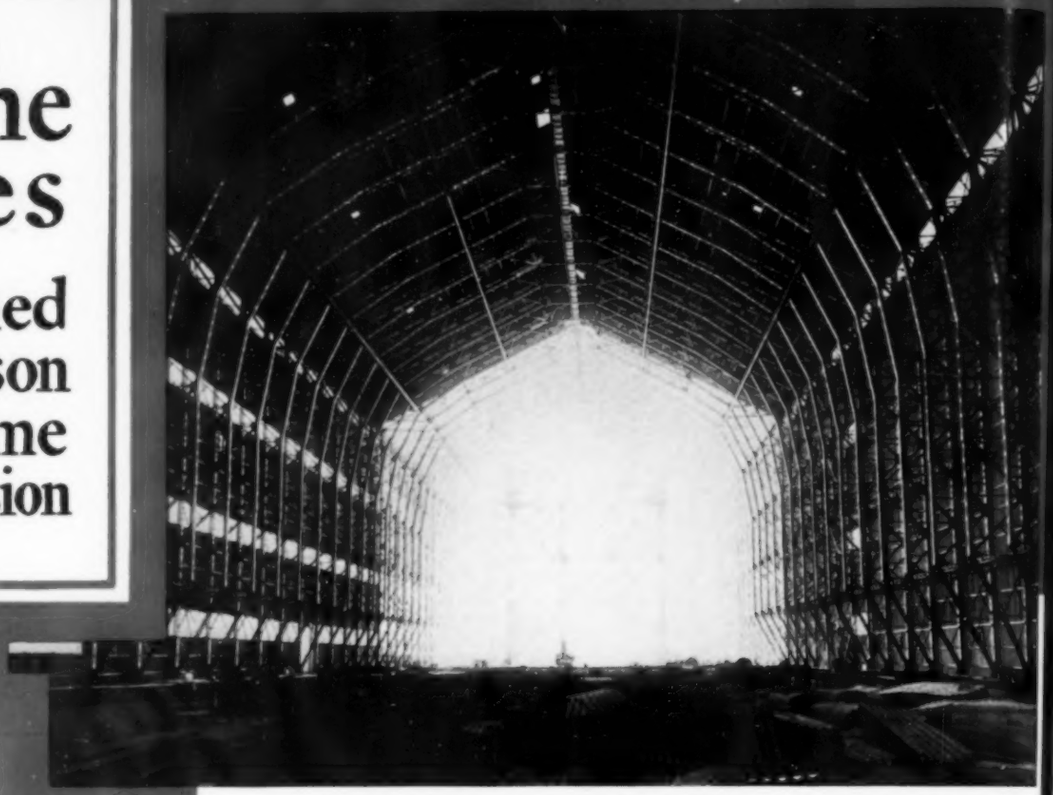
On every continent...

ROBERTSON HAS CONTRIBUTED TO THE LOWERING OF BUILDING COSTS

The Story is on the other side →

Even the far places

have learned *that* Robertson has overcome *building* corrosion



At Karachi, in India, on the Arabian Sea, this largest airship shed in the world, has a roof of Robertson Protected Metal (RPM). In the Congo, too, and the Gold Coast; in China and Japan; in Egypt and Australia; in New Zealand and Sumatra; in Singapore and Persia and Spain and the Falklands . . . . in the four corners of the earth you find Robertson products waging a successful battle against corrosion.

THE only truly successful method in modern history for preventing rust and corrosion in the roofs and sidewalls of industrial buildings has been developed right here in the United States, by the H. H. Robertson Company.

Little wonder that it has leaped the seas and gone into practically every civilized country; for the red plague of corrosion is as serious a menace to the profits of industry as an epidemic is to the health of a nation.

Freedom from corrosion! The elimination of maintenance expense on building coverings! No painting! Low initial cost! And such complete adaptability that if your buildings need to be enlarged or re-arranged this can be done without loss and without large expense . . . . . These are the advantages of Robertson Protected Metal (RPM).

The Robertson Process is based on the principle of permanent external protection for corrugated steel . . . . . permanent external coatings that keep all destructive agencies entirely away from the steel.

Corrugated steel is an ideal material for covering buildings . . . . . if it can be stopped from corroding. The Robertson Process makes it possible to take that ideal, low-cost, adaptable material and make it as permanent as you want your building to be.

No matter what corner of the globe your plant is in . . . . . no matter what the climatic conditions . . . . . no matter what the corrosion problem . . . . . Rcbertson engineers have had ample experience with just such corrosion problems before. Send us your problem and let us offer a solution. It will cost you nothing.

H. H. ROBERTSON COMPANY · 1st NATIONAL BANK BLDG., PITTSBURGH

ROBERTSON

WORLD WIDE BUILDING SERVICE

A WORLD-WIDE BUILDING SERVICE

There are Robertson offices or representatives in the following cities:

EUROPE

London, Eng. — Manchester, Eng.
Leeds, Eng. — Liverpool, Eng.
Sheffield, Eng. — Birmingham, Eng.
Newcastle, Eng. — Leicester, Eng.
Birkenhead, Eng.
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Cardiff, Wales — Glasgow, Scotland
Dublin, Ireland — Belfast, Ireland
Brussels, Belgium
Hamburg, Germany
The Hague, Holland — Athens, Greece
Malmo, Sweden

ASIA

Colombo, Ceylon — Hongkong, China
Shanghai, China
Yokohama, Tokio and other cities in Japan
Bombay, India — Calcutta, India
Karachi, India — Madras, India
Quilon, South India
Singapore, Straits Settlement

AFRICA

Cairo, Egypt — Khartoum, Sudan
Nairobi, Kenya Colony
Accra, Gold Coast Colony
Lagos, Nigeria — Durban, South Africa
Johannesburg, South Africa
Port Louis, Mauritius

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Sarnia, Canada
St. Johns, Newfoundland
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Havana, Cuba — Curacao, D.W.I.
Kingston, Jamaica
San Juan, Porto Rico
St. Thomas, Virgin Islands
Bridgetown, Barbados
Port of Spain, Trinidad

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Belize, British Honduras
Colon, Canal Zone
Guatamala City, Guatamala
Managua, Nicaragua
Panama, Panama
San Salvador, Salvador

SOUTH AMERICA

Buenos Aires, Argentina
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Valparaiso, Chile
Barranaquilla, Colombia
Bogota, Colombia — Cali, Colombia
Medellin, Colombia — Lima, Peru
Montevideo, Uruguay
Caracas, Venezuela

OCEANIA

Melbourne, Australia
Sydney, Australia — Honolulu, Hawaii
Manila, Philippine Islands
Auckland, New Zealand

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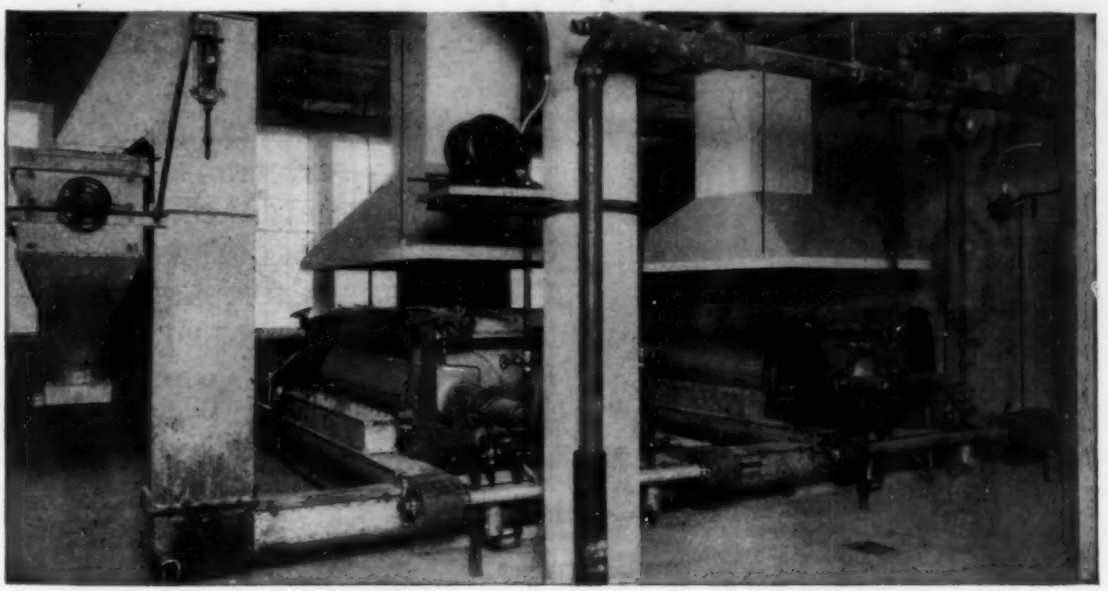


BUFFLOVAK DOUBLE DRUM DRYERS

ATMOSPHERIC TYPE

Successfully dry either dilute or heavy liquors

THROUGH a wide range of materials from Rayon products through to milk, BUFFLOVAK Double Drum Dryers are being used in increasing numbers because they successfully meet certain drying problems.

Either dilute or heavy liquors can be economically dried without any change in the equipment. This range of application is possible because the material is delivered into the space formed between drums and end boards. Here, in the case of dilute liquors, a partial concentration occurs caused by the heated drums. Many liquors that are heavy and viscous can also be dried because they are kept hot and fluid.

There are no feeding or circulating systems to clog; once the material is delivered between the drums it is never recirculated.

Salts of limited solubility can also be successfully handled because any salts which separate out adhere to the drum surfaces when the solution is brought to saturation at the boiling point.

The BUFFLOVAK Research Laboratory is equipped with one of these dryers, for the purpose of testing the various products of customers.

PRODUCTS

Acetates
Aluminum Sulfate
Ammonium Chloride
Ammonium Salts
Arsenates
Benzoates
Bichromates
Buttermilk
Chromates
Citrates
Ferrocyanides
Ferric Chloride
Formates
Hypophosphites
Lactates
Milk
Oxalates
Packing House Glue
Permanganates
Rhodanides
Salicylates
Stannates
Sulfite Waste
Sulfonates
Thiosulfates
Tanning Extracts
Tartrates
Tungstates
Vanadates
Vegetable Glues
Some of the Borates

BUFFALO FOUNDRY & MACHINE CO.

1551 Fillmore Ave., Buffalo, N. Y.

CHICAGO NEW YORK ST. LOUIS SAN FRANCISCO

EVAPORATORS—DRYERS—CHEMICAL EQUIPMENT

"HURRICANE" Truck Tray Dryer of the Type Used for Lithopone, White Lead, Dry Colors, Oxides, Dyes, Copra and Pharmaceuticals. Automatic Continuous Dryers are built for larger quantities

Rapid and Economical

DRYING

for Your Product

SOME products require exceedingly close control of temperature and humidity during drying. or others, high-speed, low cost production is the all-important consideration.

Pharmaceuticals, Pigments and a great many other chemicals, both light and heavy, are being successfully dried in "HURRICANE" Dryers. Every Dryer is *guaranteed* for definite performance.

"HURRICANE" engineers have had more than 30 years' experience with a great variety of drying problems. Perhaps they can help you produce more efficiently, or improve the quality of your product, as they have done for many others.

THE PHILADELPHIA DRYING MACHINERY CO.

3351 Stokley St. Philadelphia, Pa.

New England Office: 53 State St., Boston, Mass.

HURRICANE *Ideal Drying Every Day*

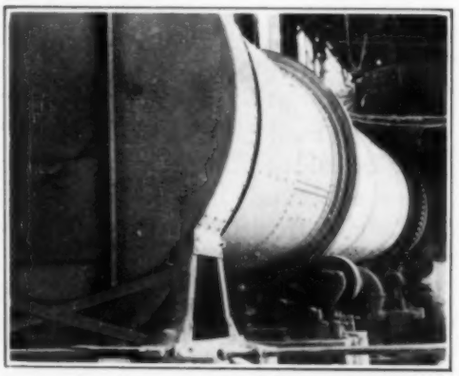
114

C. H. WHEELER of

SURFACE CONDENSERS
JET CONDENSERS
BAROMETRIC CONDENSERS
OIL VAPOR CONDENSERS FOR
HIGH VACUUM DISTILLATION
LEACH FRACTO CONDENSERS
AND HEAT EXCHANGERS
RADOJET AIR PUMPS FOR VACUA
UP TO 29.95 INCHES
FORCED AND NATURAL DRAFT
COOLING TOWERS

C. H. Wheeler Manufacturing Co.
19th St., Lehigh and Sedgley Aves.
Philadelphia

PHILADELPHIA



One of our 8-ft. 6-in.x65-ft. Dryers in a Cement Plant
Christie Dryers are made in various designs to fit any specific need.

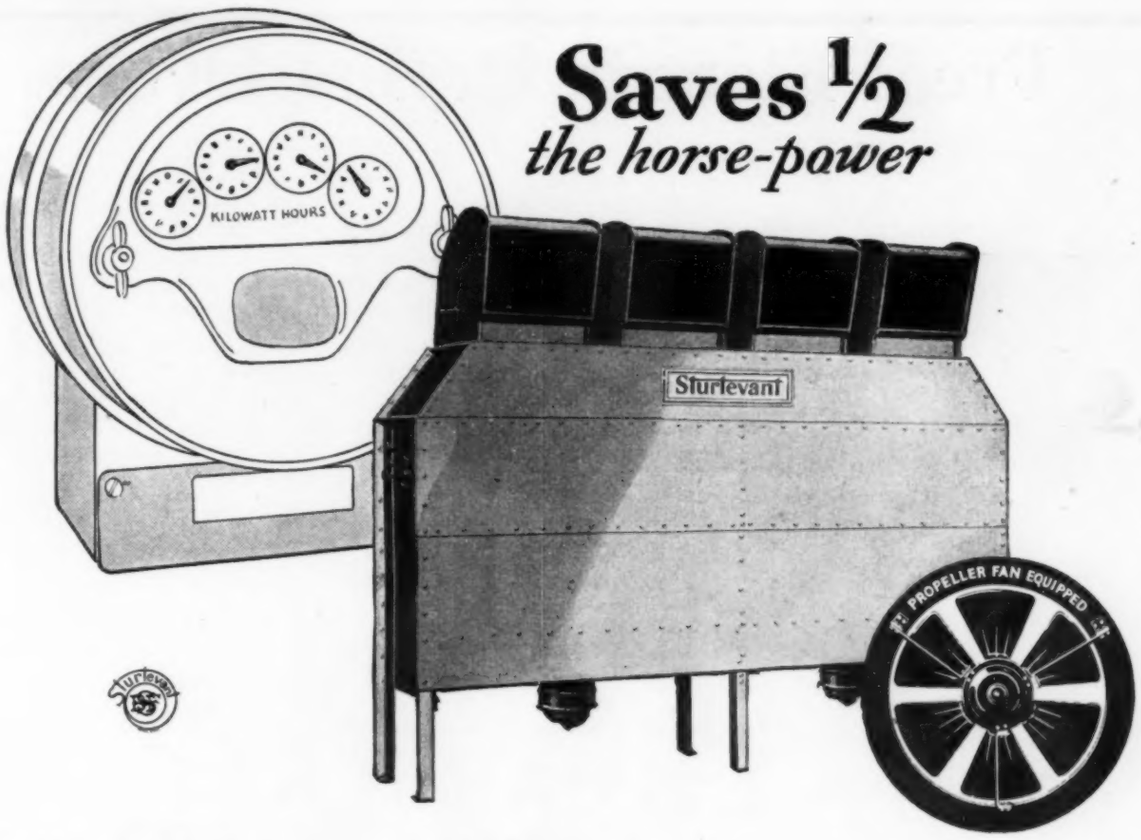
Your success depends on the selection of Proper Equipment. *Our* success depends on supplying YOU with Proper Equipment

We design and manufacture
CHRISTIE ROTARY DRYERS AND CALCINERS
SHAFT OR ROTARY LIME KILNS
MECHANICAL AND HAND-POKED
GAS PRODUCERS
STEEL TANKS AND STACKS
STEEL PLATE CONSTRUCTION OF ALL KINDS

Adopt Our Recommendations
They're Safer

DUFF PATENTS CO., INC.

320 Union Trust Bldg., Pittsburgh, Pa.



Saves ½ *the horse-power*

"The Meter will prove our point!"

The "Tempervane" requires 50% less current than units equipped with centrifugal type fans!

LET a Sturtevant Engineer explain how the "Tempervane" effects this economy in industrial heating—

"The 'Tempervane' Unit Heater utilizes Aerofin heating elements. These elements offer a very low resistance to air. Propeller fans operate at their highest efficiency against low resistances, whereas centrifugal fans operate at lowest efficiency against low resistances.

"The issue was plain and clean cut. We chose propeller fans, cut motor horsepower fifty per cent and halved the current consumption. Exhaustive laboratory and service tests have proved we were right—and the meter will prove our point!"

Suspended type "Tempervane"

Precedent played no part in the design of the "Tempervane". It would have been just as easy to have specified centrifugal fans (of which, Sturtevant manufactures thousands), but our Engineers were out to design a better unit heater ... better in performance ... most economical in current consumption.

The "Tempervane" is the result. It has been subjected to the most exacting laboratory and service tests ever conducted . . . It has proved itself by meeting the highest standard ever established for industrial heating equipment.

We would welcome your request for indisputable evidence of "Tempervane" economy. Write our nearest office for Catalog 363.

B. F. STURTEVANT COMPANY

Plants and Offices at: Berkeley, Cal.•Camden, N. J.•Framingham, Mass.•Galt, Ontario •Hyde Park, Mass.•Sturtevant, Wis.

Branch Offices at: Atlanta; Birmingham; Boston; Buffalo; Camden; Charlotte; Chicago; Cincinnati; Cleveland; Dallas; Denver; Detroit; Hartford; Indianapolis; Kansas City; Los Angeles; Milwaukee; Minneapolis; New York; Omaha; Pittsburgh; Portland; Rochester; St. Louis; San Francisco; Seattle; Washington, D. C.; *Canadian Offices at:* Toronto, Montreal and Galt.

Also Agents in Principal Foreign Countries.

Sturtevant REG. U.S. PAT. OFF. *Tempervane* **Heating Units**

Freas Electric Drying Ovens

Vacuum Type

THESE WELL-KNOWN OVENS, through their reliable performance, have proven, through the course of years, a superiority over other products of this character which is undisputed and which has given them the position of the standard oven of its kind today. Several other types of ovens have appeared on the market, but have either not been able to reach the degree of accuracy that is attained in the Freas oven, or have been so complicated that they have not been found satisfactory in practical use.

The Freas electric oven automatically controls the heat to a constancy of ½° Centigrade and will maintain that temperature as long as the current is on. The heating units are easily removable and replaceable by the operator. The walls are very heavily insulated and the entire mechanism of the make and break is outside of the service chamber. This precludes danger from explosion of volatile gases evolved during the drying process.

The oven is made in a number of different sizes and styles, and covers a field of utility far in excess of any other constant temperature oven.

As district distributors for the entire line of Freas and Thelco products we carry a heavy assortment of different types of ovens and incubators in stock, and are prepared to make prompt shipment.—Complete detailed information as to construction, method of operation, types, etc., will be cheerfully furnished upon request, at any time.

Descriptive Price List Upon Application

E. H. SARGENT & CO.

155-165 East Superior Street · · · CHICAGO, ILL.

LABORATORY SUPPLIES

4033

NICHOLS HERRESHOFF FURNACE

for

ROASTING - CALCINING - DRYING

Write for Bulletin No. 200

We invite consultation on your problems

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25 Broad Street
NEW YORK, N. Y.

PACIFIC FOUNDRY COMPANY
18th and Harrison Streets
SAN FRANCISCO, CALIFORNIA

*FOREIGN DISTRIBUTORS

Huntington, Heberlein & Co., Ltd., London, England

Mitsui & Co., Tokio, Japan.

Metallbank und Metallurgische Gesellschaft, Frankfurt, a. M., Germany

"Do it electrically" with Freas Ovens —for 3 good reasons

1. *Faster Production*—because of greater speed of heat transfer to the work; ability to use higher temperatures with safety; adaption to a set routine with consistent accuracy of performance.
2. *Better Quality of Product*—because of the cleanliness of electric heat—no dirt or undesirables of combustion to contaminate products; and uniform heat distribution eliminates distortions due to localized heating.
3. *Greater Economy of Operation*—because of higher efficiencies inherent in electric heating; economies of automatic control, savings in time, floor space, and materials; and reductions in labor and supervision.

In comparison with fuel and gas fired ovens—economic and production advantages are overwhelmingly in favor of Freas Electric Ovens. Freas Ovens are made in standard and special sizes, and also built to specifications. We shall be pleased to furnish any information desired.

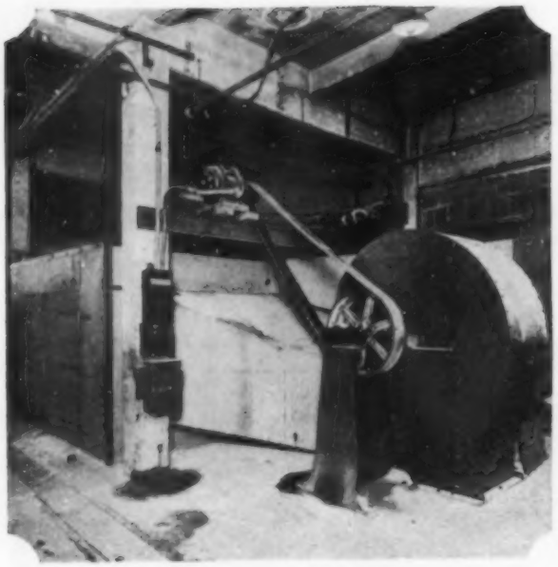
FREAS Thermo-Electric Company

FREAS

ELECTRIC HEAT AUTOMATICALLY CONTROLLED

1209 South Grove Street Irvington, N. J.

Electric Industrial and Laboratory Ovens



To Meet Individual Drying Requirements

Whatever your requirements may be, Sturtevant Drying Equipment can meet your needs exactly. Sturtevant manufactures a large and varied line of drying equipment and is therefore able to give unprejudiced advice regarding the application of such apparatus to each individual job.

Our engineers believe in fitting the equipment to the job and not in fitting the job to the equipment. We will gladly study your drying problem and recommend the kind of equipment that will work for you most efficiently and economically.

B. F. STURTEVANT COMPANY
HYDE PARK, BOSTON, MASS.
Offices in principal cities

Sturtevant
(REG·U·S·PAT·OFF·)

Drying Equipment

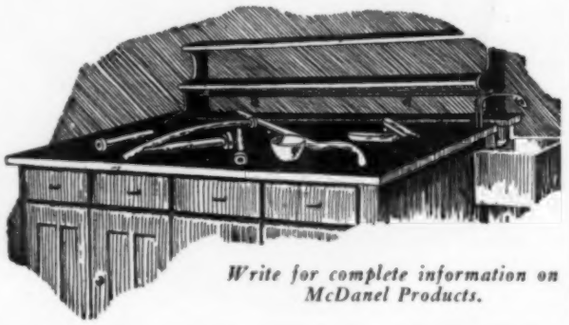
McDanel Refractory Pyrometer Tubes and Protection Tubes

Years of experience in the refractory porcelain business plus a large number of tests of actual operation assure you that McDanel Products are right in every respect. In these tests, McDanel Tubes have proven to be far superior to various other makes. It will pay all pyrometer users to specify McDanel Tubes with their instruments or next replacement order from their instrument makers.

We have also developed a very successful combustion tube for carbon determination which has met with marked success.

TRADE MARK

McDanel Refractory Porcelain Co.
Beaver Falls, Pa.

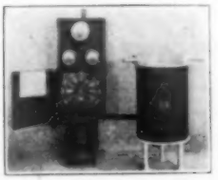


Write for complete information on McDanel Products.

Determining Correct Heat Treatment By Duplicating Shop Conditions In The Laboratory

The **Hevi Duty Electro-Magnetic Furnace** finds ready application in metallurgical laboratories to determine and establish the best working cycle for effective heat treatment. In testing, the temperatures applied in production are duplicated. The exact rate of heating is reproduced. Therefore, the data obtained can be applied to production, with the assurance that the excellent test piece of the laboratory will be a fair sample of the work of production.

There's a Hevi Duty representative in your territory. He will gladly go into details regarding this magnetic detector.



Typical vertical furnace with standard control equipment.

HEVI DUTY ELECTRIC CO.
MILWAUKEE, WISCONSIN

Building Profits for You

These men are building more than a dryer ...they're creating a means to lower costs!

We pride ourselves on doing a great deal more than merely building drying machinery. Most any one with money enough to equip a plant can do that. Our greatest asset, as we see it, is the organization whose engineering ability enables us to show you manufacturers how to decrease your drying costs and thus increase your profits.

That is why we are represented not by salesmen but by trained drying engineers. It is their function to go into your plant, study your present methods and then, with our experience to guide them, suggest a way to dry your product more efficiently and economically.

At the disposal of these men is all the knowledge that we have gained in forty years of building drying machinery. Having served more than a thousand manufacturers among fifty different industries, we attack with confidence any drying problem, anywhere.

That this confidence is justified is proved by the record of results. We can point to fuel savings of 61%, labor savings of 76%, space savings of 83% and production increases of 100%. Any number of installations have paid for themselves in as little as one year's time—surely a handsome return for a little intelligent listening.

Why not avail yourself of the accumulated knowledge of this pioneer dryer building company? It costs nothing to consult a Louisville Drying Engineer, and the suggestions he may be able to make may be worth thousands of dollars to you.

5 Ways
to cut drying costs

1 The first way is to permit Louisville Drying Engineers to make a study of your drying problems. They will recommend a Louisville Dryer which will—

2 Cut fuel expense from one-third to one-half in many cases;

3 Deliver dried material *continuously*, thus permitting of uninterrupted plant operation;

4 Cut the number of attendants needed to one in most instances;

5 Reduce the amount of floor space required as much as 80%.

LOUISVILLE
DRYING MACHINERY COMPANY.
Incorporated.
451 Baxter Ave., Louisville, Ky.
Cable Address, Loudry, Louisville, Kentucky

Pin to Letterhead

Mail to Louisville Drying Machinery Co., 451 Baxter Ave., Louisville, Ky., for further particulars of the service offered by Louisville Drying Engineers. No obligation.

Name .....

Extract from
MORNING POST
London

December 7, 1927.

STEEL MELTED BY RADIO

Furnace in Wooden Box

SHEFFIELD'S SECRET

Financial Aspect of New Discovery

From Our Own Correspondent

SHEFFIELD, Tuesday.

Sheffield has again given a lead to the world in the science of steel manufacture by providing the first high frequency electrical furnace which melts steel by wireless. ...minates heat

SHEFFIELD—"The Home of Steel" Endorses the AJAX-NORTHRUP High Frequency Induction Furnace

The furnace referred to in the clipping is an Ajax-Northrup high frequency crucible furnace, used for the manufacture of high quality tool steel, having a market value ranging from $250 to $750 per ton.

A demonstration at Edgar Allen and Co., Ltd., Sheffield, England, proved both the technical and economical advantages of the Ajax-Northrup furnace.

Among the technical advantages are: purity of the steel produced; homogeneity of the metal because of the electrical stirring of the metal; temperature control; cleanliness of operation, etc.

The old methods of melting took three to four hours to melt 60 pounds of high-speed steel; The Ajax-Northrup furnace will melt 450 pounds in from 50 to 55 minutes at one-half to two-thirds the cost per ton!

Send for a complete copy of this clipping— it's an interesting story.

G. H. CLAMER
President

AJAX

E. F. NORTHRUP
V. Pres. & Tech. Adviser.

Ajax Electrothermic Corporation
Trenton, New Jersey

A—50 Pound 'Lectromelt Furnace For Laboratories

Operates on 110 volts, single phase A. C. Direct, Indirect or Submerged Arc

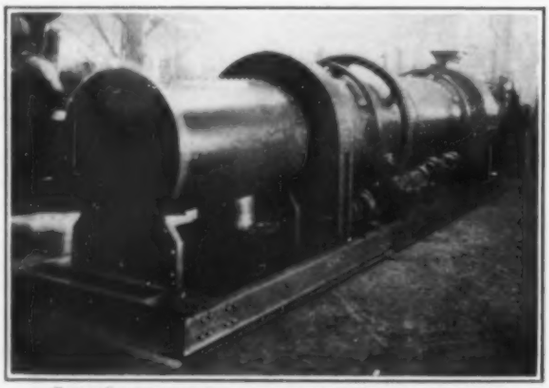
This furnace finds its greatest use in research laboratories, specialty manufacturing plants and technical schools.

It is used for melting irons, steels, ferrous alloys, non-ferrous metals and alloys, fusion investigations, ore reductions, refractory experiments and similar work.

PITTSBURGH ELECTRIC FURNACE CORPORATION

Manufacturers of 'Lectromelt Furnaces up to 50 tons capacity for Carbon and Alloy Steels, Gray and Malleable Irons. Special Furnaces for Carbide, Ferro-Alloys, etc.

Post Office Box: 1125 PITTSBURGH, PA.



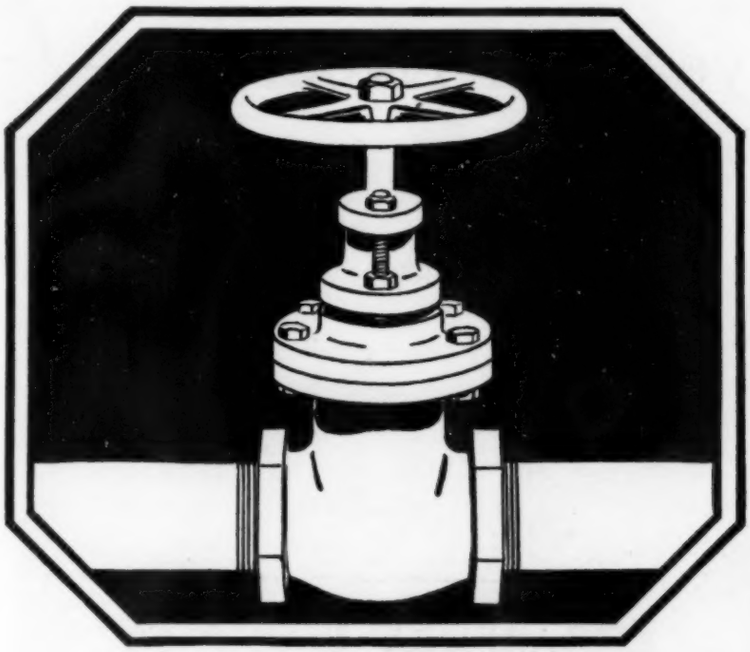
General purpose Dryer. Can be oil, gas or steam heated. Sizes 12 to 20 ft. by 36 to 60 in.

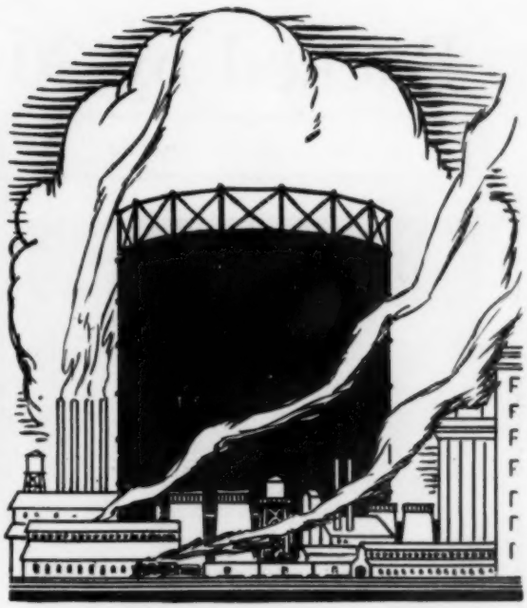
WE HAVE been building dryers for the Process Industries since 1908. We have successful installations on salt, graphite, fertilizer materials, garbage, sewage sludge, reclaimed rubber, coal, chemicals, pigments, leather scrub, fish scrap, wood chips, cement, lime, glass, sand, etc.

We have ten different models and nine different sizes, one of which will fit your need.

Send for catalog.

The W. E. Prindle Mfg. Co.
Successors to Buckeye Dryer Co.
187 W. Lakeview Ave., Columbus, Ohio





HEAT—
the instant you want it!

The moment you are ready for your gas flame, it springs into *full action!*

Likewise, at your will, it is instantly and completely extinguished.

When you use gas, there is no carrying over of fires during periods when heat is not wanted.

Nor is time lost in bringing a fire up to the required temperature.

This feature alone of gas for industrial uses is important. It represents a valuable saving of time; conservation of man-power, and economy of operation.

More than that, the *flexibility* of gas, which makes possible this very feature, insures *perfect temperature control* for every manufacturing process.

Quite naturally, this makes for improved products and fewer rejections.

Considering all the many advantages afforded by gas—of which these are but a few—it is no wonder that industry is today employing gas in 60,000 different ways!

Your local gas company will be glad to tell you how gas can be profitably employed in *your* plant. Telephone or write to them—your inquiry will not obligate you.

For free copy of book, "Industrial Gas Heat", address

American Gas Association
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YOU CAN DO IT BETTER WITH GAS

Backed by 20 years of Experience!

SULPHATE BLACK LIQUOR

BODIES 108-IN. DIAMETER

EVERY Zaremba Evaporator reflects long experience in meeting the special requirements of different plants throughout the industries.

From the very beginning—twenty years ago—the spirit of helpful service, coupled with a scientific knowledge and painstaking study, has been demonstrated by Zaremba Engineers.

Whatever your evaporator requirements specify Zaremba and you'll be sure of the evaporator best suited.

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METTLER ENTRAINED COMBUSTION GAS BURNERS

are guaranteed to produce the best results obtainable from combustion of gas (City gas, coke oven gas, natural or still gas). Since all air for combustion is taken in through the burner itself, either reducing, neutral or oxidizing flame can be obtained by adjusting the air damper. Mettler Burners are suitable for all kinds of boilers and furnaces.

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W. N. BEST Oil Burners

One of several furnaces heating pipe ends for vanstoning at Benj. F. Shaw Co. plant, Wilmington.

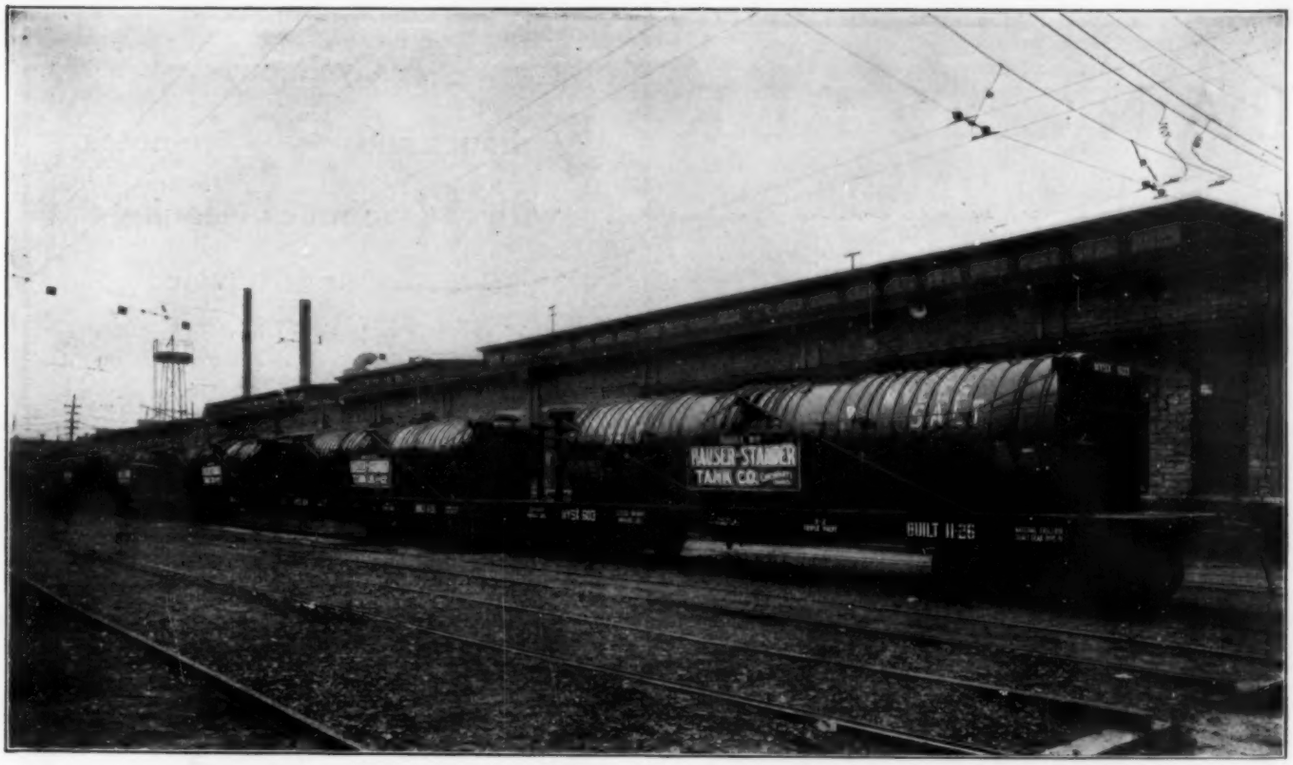
There is a Best Oil Burner for practically every industrial heating requirement.

With ability to furnish proper sizes and types soundly engineered, each application insures satisfactory results.

If you are looking for Oil Burning Equipment that is dependable and efficient, send your inquiries to "Best." Catalogs sent upon request.

W. N. BEST CORPORATION
Engineers and Manufacturers Since 1890
Greeley Sq. Bldg., Sixth Ave. & 31st St., New York, N. Y.

Battery of forty-two 250 hp. boilers in Pacific Mills fired by W. N. BEST High Pressure Oil Burners.



Special linings for special purpose Wood Tanks

HAUSER-STANDER - - - -

We show tank cars, rubber lined by a special process to carry concentrated muriatic acid. The lower illustration is a special measuring tank with Duriron Gauge Glass, Fittings and Outlet.

One of the advantages offered in Hauser-Stander Wood Tanks is adaptability to the job.

Years of experience in meeting all manner of wood tank uses enable us to design, build, and erect tanks that will give longer, better service.

Protecting linings of Rubber, Wood, Lead, etc., are common to Hauser-Stander Wood Tanks. Tell us the use you wish to make of a wood tank and we will suggest the correct tank for your service.

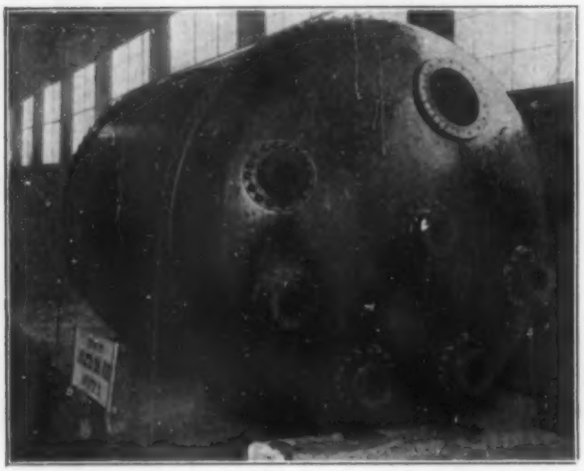
In many instances we have furnished tanks with proper outlets, agitators, heating coils and other special parts.

Our catalog shows many adaptations of Hauser-Stander Tanks and will be of interest and value to anyone considering a wood tank. Write for a copy.

THE HAUSER-STANDER TANK CO.

CINCINNATI, OHIO

LANCASTER
STEEL PLATE PRODUCTS



Kettle 9 ft. 5 in. dia. x 15 ft. 8 in. long having Special Radius Heads and Forged Steel Nozzles for Pressure Work in a large Chemical Plant.

Pressure Vessels or Storage Tanks, Rotary Kilns, and Driers, Retorts, Stills, Towers, Stacks and Breechings

Specialists in Fabrication of High Chrome Alloys

You will reduce your Ultimate Cost of Equipment and Operating Difficulties from Heat, Pressure, and Corrosion, by combining Our Fabrication Experience with your own General Design.

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A Cycle of

7 hours and 52 minutes with 8 minutes cleaning and Repeat

One of our Vallez Rotating Leaf Filters has been running continuously for four years on that cycle, on black liquor.

That Cuts Costs

Only eight minutes' labor per shift! This filter will handle material so dilute that a cake would not form on a continuous filter.

We Build

High Duty Vacuum Rotary Filters	
Vacuum Pressure Filters	
Evaporators	
Condensors	**Stills**
Saturators	**Kilns**
Settlers	**Driers**
Retorts	**Towers**

Tell us your problem. It is no harder than others our engineering department has solved.

JOUBERT & GOSLIN MACHINE & FOUNDRY CO.
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New York Office: 82 Beaver Street. *Cable Address:* "JOUGOS"

Coatesville Scotch Marine Type Boiler

Why Do We Stress EXPERIENCE?
(1888-1928)

Our forty years' experience in boiler and steel plate fabrication enables our Engineering Department to suggest the best methods of construction—and is your assurance of satisfaction when you order Coatesville products.

We make fire tube boilers of all types and sizes, Breechings, Stacks, Riveted Pipe, Digesters, Storage and Pressure Tanks, Autoclaves, Kilns, and Heavy Steel Plate Work of any description.

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Boilers - Tanks - Steel Plate Work

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General Ceramics Stoneware is designed by experienced engineers to insure the greatest mechanical strength and resistance to stresses caused by temperature changes.

The material is incorrodible and cannot be penetrated by the most concentrated acid. It is vitrified clear through and is leak proof.

Long life under the hardest conditions proves its high quality.

G-C Products include:

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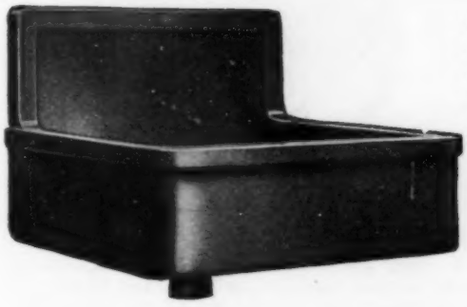
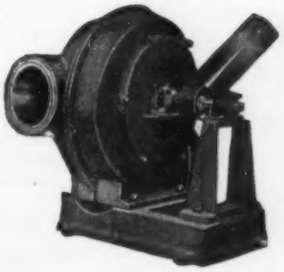


A large stock of standard equipment—a selection from which will fill practically every need at a decided cost saving to the user. If the conditions require, we have every facility to insure prompt design and delivery of special equipment.

Write us for Bulletins



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Sales Offices: 276 Monadnock Bldg., San Francisco. 208 So. La Salle St., Chicago
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The NILES "Ringseal" Steel Container

Laughs at Rough Treatment

Patent Pending

No terrors of shipping loss need be feared when your product is carried in this strong, attractive steel container.

A Rugged Container

That Seals Perfectly

WHAT a satisfaction it is to the manufacturer as well as to the ultimate purchaser, to know that every shipment will come through safely. No damage—no leaks, whether for local or export shipping, when you adopt the popular NILES "Ringseal" Container. A single stroke seals this pail perfectly, and it opens with equal ease. Ideal for shipping Paints, Greases, Soaps, Edible Fats, Fruit Juices, Chemicals, etc.

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Offered in sizes holding from 25 lbs. to 100 lbs. Can be finished in any color and any label design strikingly lithographed. Let us send you illustrated literature and complete details.

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A COMPLETE organization of structural, electrical, mechanical engineers that can plan and execute your entire plant. One contract with plans, cost, delivery date, and your complete satisfaction guaranteed.

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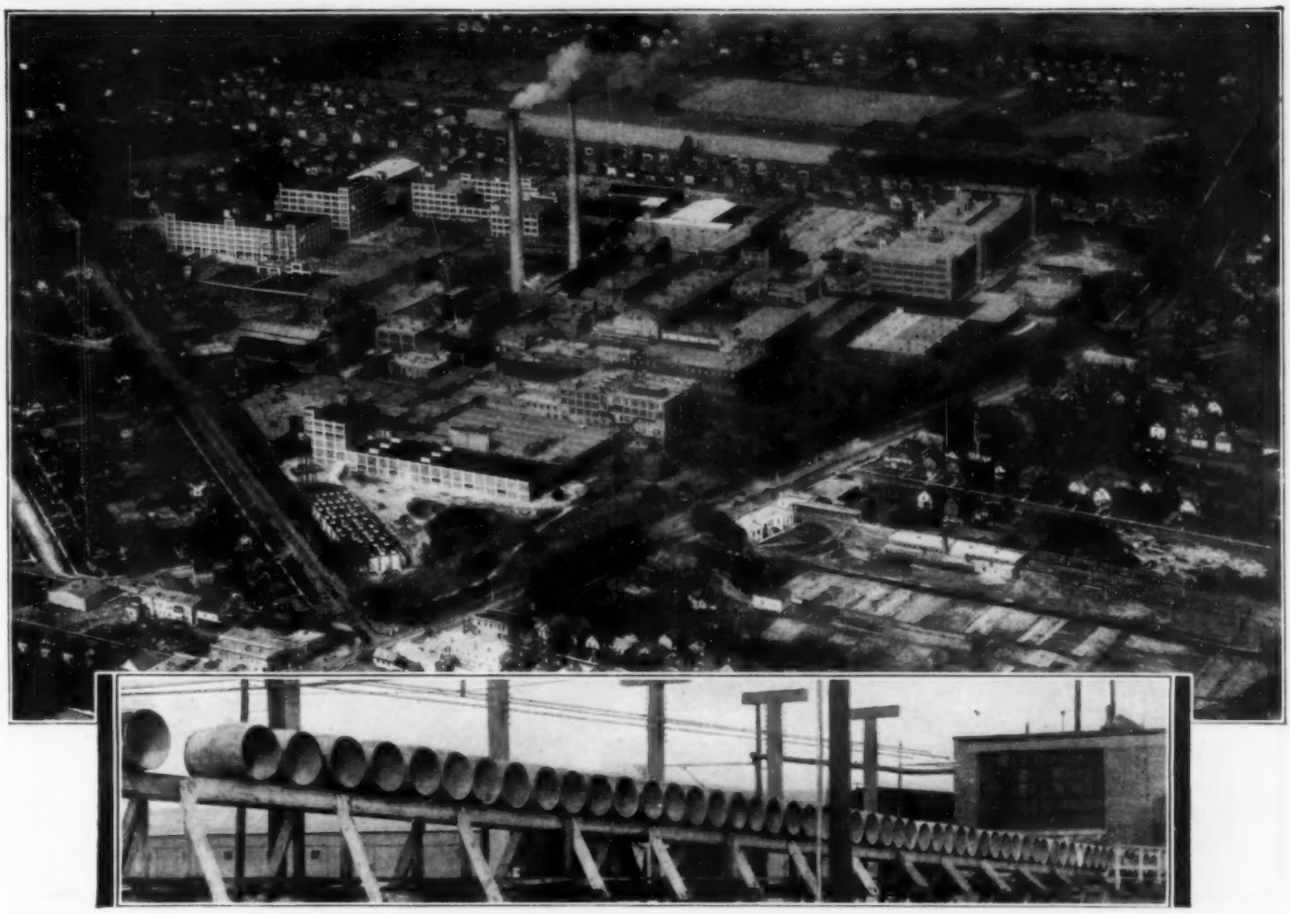
Monel metal agitating tank with coil and agitator.

Our wide experience in building and relining all kinds of tanks, chlorinators, crystallizers, retorts, blow cases, vacuum pans, etc., in Monel and Nickel, copper and many other metals and alloys, guarantees you satisfaction in equipment for the economical handling of solvents and synthetic organic chemicals. Take advantage of Liberty experience before installing Nickel or Monel Metal equipment.

Liberty Coppersmithing Co.
1708 N. Howard St., Philadelphia, Pa.



Kodak Park, where Hackney Barrels are cutting costs for the Eastman Kodak Company

If It Isn't a Hackney — it lacks the following cost cutting Hackney features *—for no other steel barrel has—*

The simple, strong, leakproof, easily removed head. The full, unobstructed opening when the head is removed. The smooth, strong bottom chime construction. The uniformly thick walls and sturdy bilged sides—free from all seams, welds, rivets and sharp corners.

The Eastman Kodak Company, like other large industrial leaders, were quick to appreciate this fact, and what it meant to them in improved service and lower shipping costs. It will pay you to investigate these facts in the interest of *your own* costs and service.

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PRESSED STEEL TANK COMPANY

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Hackney

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A Nozzle for every industry

A fine, uniform spray at low pressure.

Cooling Ponds
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Air Filters
Air Washers
Air Coolers
Flow Meters

TRADE MARK

SPRACO

It pays to come to Headquarters for Nozzles. Spraco Nozzles are in world-wide use. Leading plants in the chemical and process industries prefer them to others because of their higher efficiency, which is due to the famous "center-jet" feature.

Made in standard and special designs for all requirements. Investigate.

SPRAY ENGINEERING CO.
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Atlantic Tank & Barrel Corp'n

Wooden Tanks of all descriptions

Tight cooperage Red and White Oak

Tonnele Ave. & Hamblet Place
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Pickling Tank
30' long, 5' wide, 2' deep—2250 gals. capacity.
Hol 6% H_2SO_4—180° F.

Woolford Tanks —for Acids

Constructed of Yellow Pine, specially selected stock. All joints of exclusive design and sealed with Woolford Compound.

Rodded through the wood with acid resisting metal.

The tanks can be shipped assembled up to 40-ft. in length—knocked down on any specification.

Mail Address

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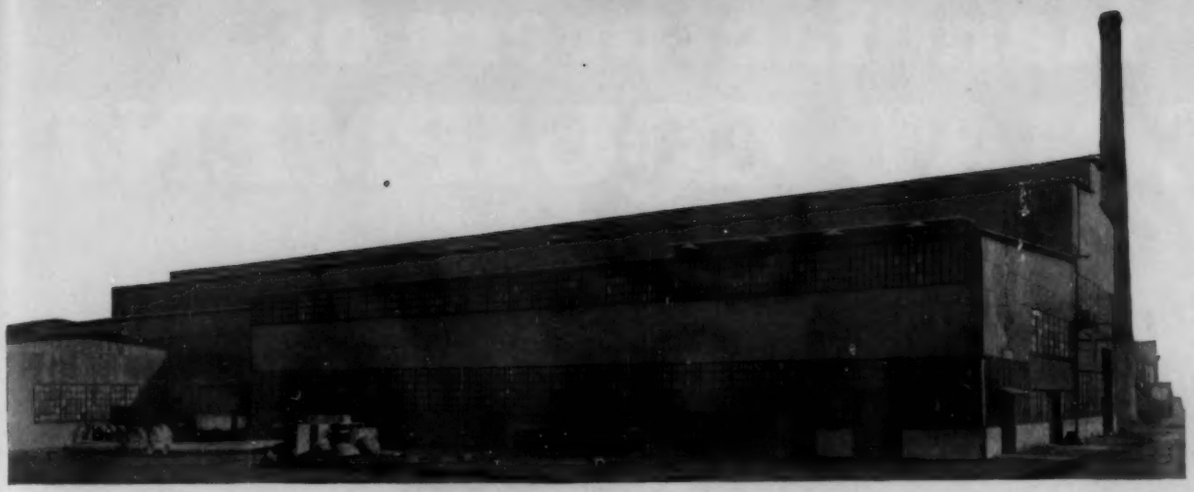

SUN BOILER AND TANK SHOP AT CHESTER, PA.

Massive Construction

THE SUN SHIPBUILDING & DRY DOCK CO. plant at Chester, Pa., is one of the largest and best equipped plants of its kind on the Atlantic Coast.

For years this company has devoted its extensive facilities to the building and repairing of large merchant vessels, Sun-Doxford Diesel Engines, and to massive iron and steel construction of every description.

We maintain a large staff of experienced and widely informed engineers and trained workmen who are accustomed to handling heavy work of great dimensions. Our plant equipment is of the most modern type and our facilities practically unlimited for large production. All work that is undertaken at the Sun plant is completed in our own organization, which includes

INTERIOR OF ONE OF THE MACHINE SHOPS

STEEL FABRICATING SHOP
BLACKSMITH SHOP — MACHINE SHOP
ELECTRIC WELDING — BOILER SHOP
ANGLESMITH SHOP — COPPERSMITH SHOP
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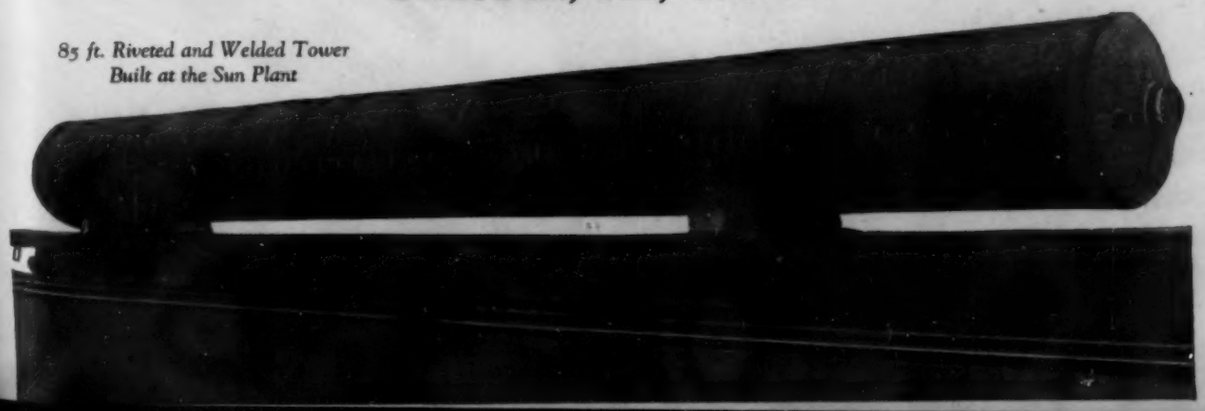
Rail or Water Shipments

Our plant is located on the Delaware River with piers and deep water for accommodating large vessels. Railroad connections to all points. Unusual loading facilities, including a 120 ton crane.

Our ENGINEERING STAFF *welcomes the opportunity to give advice on projects. Estimates gladly submitted.*

SUN SHIPBUILDING & DRY DOCK CO.
CHESTER, PA., U. S. A.

85 ft. Riveted and Welded Tower Built at the Sun Plant



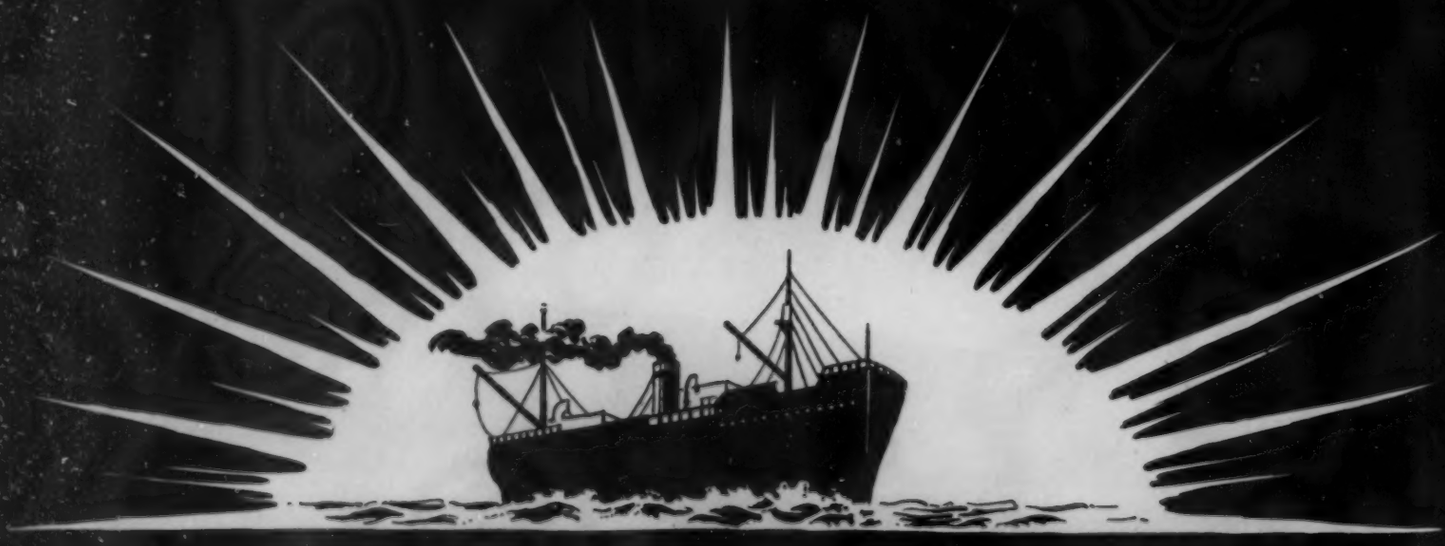
SUN SHIPBUILDING & DRY DOCK CO.

Manufacturers of
SPECIAL EQUIPMENT

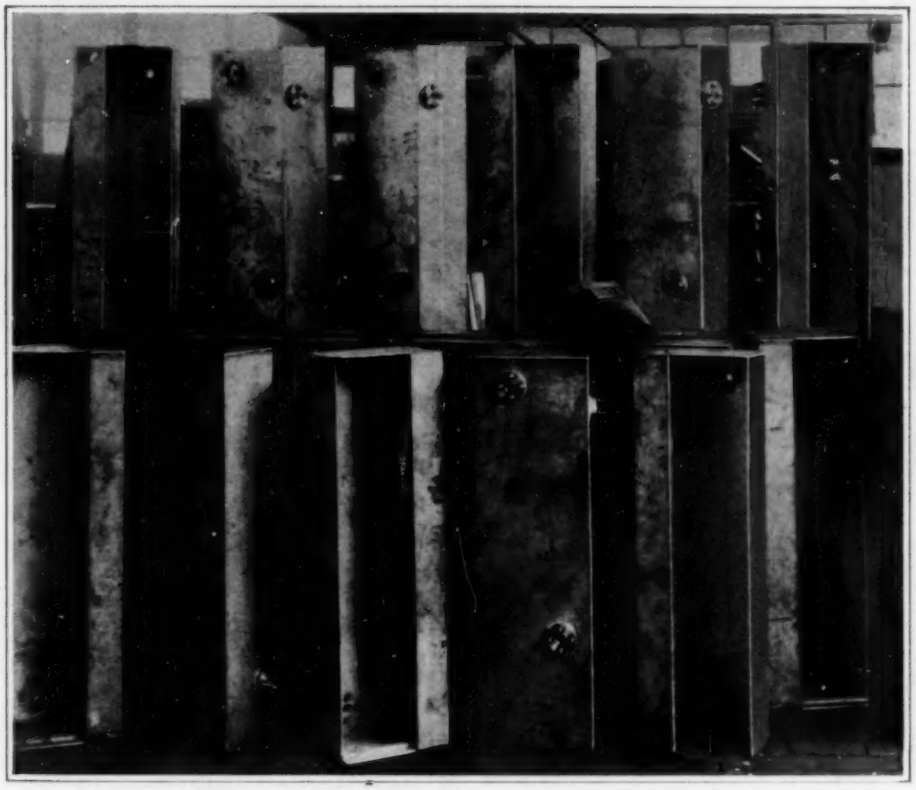
for

OIL REFINERIES
CEMENT PLANTS
POWER PLANTS
FABRICATED PLATEWORK
CHEMICAL PLANTS
PAPER MILLS
GAS PLANTS
SPECIAL MACHINERY

Estimates on Request



SUN SHIPBUILDING & DRY DOCK CO.
CHESTER, PA., U. S. A.



HIGH CHROME NICKEL
Electric Arc Welded

In order to eliminate the green verdigreas that forms on copper these tanks are now built of High Chrome Nickel, the latest development of Stainless Steels in America.

By means of our own process of electric welding we are able to guarantee that our alloy welds including the weld area will equal the joined plates in resistance to corrosion attack.

We Furnish to Your Specifications in the following Chromium Alloys:

Ascoloy, Allegheny Metal, Cyclops, Delhi, Duraloy, Enduro, KA-2, KA-2S, Lesco, Rezistal, Uniloy Nickel and Monel.

—Equipment such as
Piping
Kettles
Towers
Acid Proof Hoods
Digesters
Storage Tanks
Lined Tanks
Vacuum Pans
Anything in Plate Construction

Our wide experience in fabricating all grades of Chrome Iron and Chrome Nickel Alloys will be of great value to you in helping you select that alloy best suited to your particular job.

For the past three years we have without question led the field in the successful welding of Chrome Iron and Chrome Nickel Alloys.

INDUSTRIAL WELDED PRODUCTS CO.

Newark, N. J., Plant:
Lentz and Roanoke Aves.

New York Office:
1054 Grand Central Terminal Bldg.

Now's The Time To Think of Next Year's Tanks

This is the time to consider those new tank items for the 1929 budget. And when you think of new tanks think of GENCO TANX because they are so good.

For Years, GENCO TANX have been recognized as above the average in tank values. Their fine workmanship and first class materials have stood the test of time and have proven their value in service.

Let us send you a quotation right now so you can include this item on the coming budget.

Any Tank for Its Given Purpose

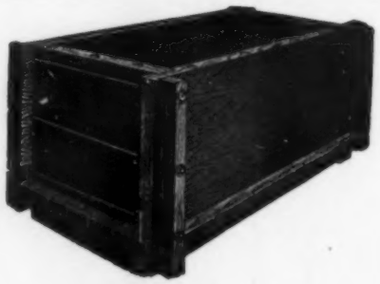
We build a general line of high grade wooden tanks in all sizes to meet specific requirements—all woods.

Genco Tanks with Special Linings such as lead, copper, pitch, china wood oil, etc., are among the best.

We also build:—

Genco Agitators and Agitator Drives
Steel Tanks: Riveted and Welded
Towers: Wood & Steel
Cold Cutters

The **GENERAL TANK CORPORATION**
30 Church St., New York, N. Y.



Tanks for all purposes

—built of Redwood or Fir lumber. Made any size or shape. Hooped off or bolted with MONEL METAL when desired.

We also manufacture dye vats, water tanks; etc.

Write for catalogues containing capacity tables and other data.

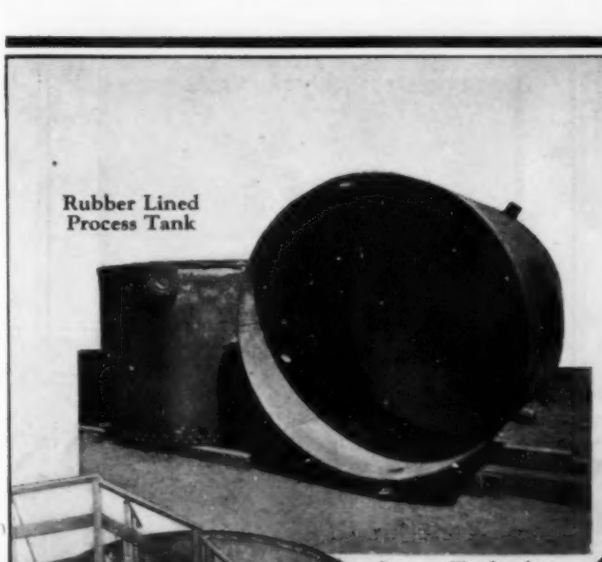
PACIFIC TANK & PIPE CO.
334 Market St., San Francisco
55 West 42d Street, New York
417 Kearns Bldg., Salt Lake City

PacificTanks

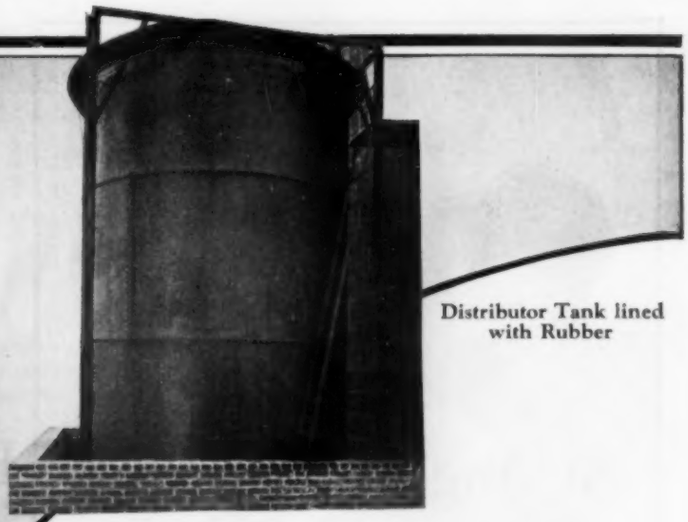
WELDING of Chrome Iron, Stainless Steel for nitric acid resisting equipment. Aluminum, nickel and monel equipment with welded construction. Homogeneous lead linings and chemical lead burning.

NIAGARA BLOWER COMPANY
673 Ontario St. Buffalo, N. Y.
New York Office: 95 Liberty Street

Also manufacturers of Air Engineering Products and Systems for chemical process industries



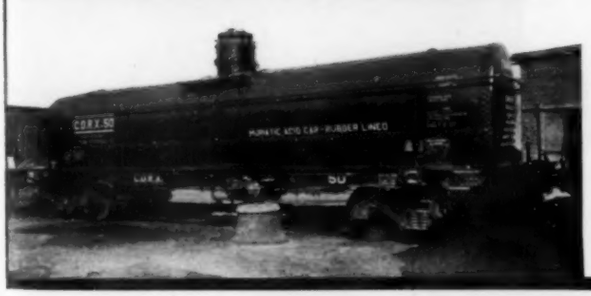
Rubber Lined Process Tank



Distributor Tank lined with Rubber

Storage Tank where rubber lining is installed

Flue Pipes for Blower System lined with Rubber



RUBBER

for the better protection of Metal and Wood Surfaces Against Chemical Action

WHEREVER acid and corrosive materials must be transported, handled and stored, you will find a practical, economical solution in "U. S." Rubber Lined Tanks, Shipping Containers, Tank Cars, Dippers, Buckets, Plating Equipment, etc.

"U. S." Soft Rubber Linings are permanently fastened to either metal or wood surfaces. This tough, resilient rubber lining is non-corrosive, non-absorptive and resists acid and wear to the maximum. The rubber compound being *flexible* readily conforms to the expansion and contraction of the metal surfaces. All seams are vulcanized into *one* piece making the lining a leak-proof, acid-resisting jacket.

"U. S." Linings can be applied at our mills or at the customer's plant to practically any size or shape of tank or other equipment. For further information please write for our new booklet on Protective Rubber Linings.

United States Rubber Company

1790 Broadway . New York City

Branches in every industrial center

"U.S." Rubber Linings

Prevent corrosion of wood and metal surfaces

Strong preferences for strong valves

Fig. 108 Jenkins Standard Bronze Angle Valve, screwed

There are engineers by the thousands who standardize on "valves marked with the Jenkins 'Diamond' and signature." Preferences are strong, for the valves are strong and give trouble-free service year after year.

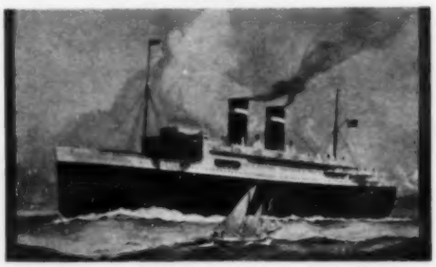
Strength is insisted upon at every stage of Jenkins manufacture. Metals are chosen with care, and are analyses-checked by competent metallurgists. Design and construction provide for strength in every detail. Assembly and tests are under thorough supervision, and a wide safety margin is allowed in proving each valve's worth in actual service before it leaves the factory.

Fig. 325 Jenkins Standard Iron Body Gate Valve, Screwed

There are Jenkins Valves in bronze and in iron for practically every requirement. They are obtainable through supply houses North, South, East or West.

JENKINS BROS. LIMITED
80 White Street.....New York, N. Y.
524 Atlantic Avenue.....Boston, Mass.
133 No. Seventh St.....Philadelphia, Pa.
646 Washington Blvd.....Chicago, Ill.
JENKINS BROS. LIMITED
Montreal, Canada London, England

Always marked with the "Diamond"
Jenkins Valves
SINCE 1864



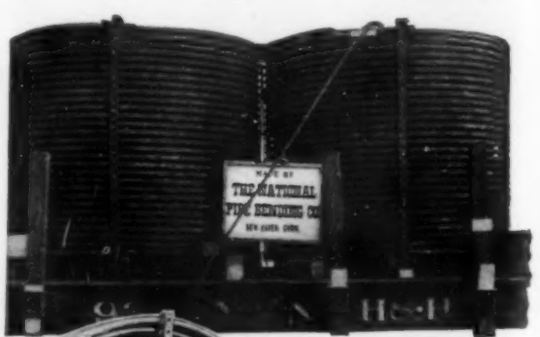
REFRIGERATION

For the Giant S/S Virginia Where National Coils Play an Important Part

THE new giant liner Virginia of the International Mercantile Marine, and its sister ship, the California, comprise the world's largest commercial vessels with electric propulsion. Perishable cargoes to and from New York and San Francisco are entrusted to refrigeration furnished by the Brunswick-Kroeschell Company, who selected for this exacting service National coils for the evaporators and condensers. The combined weight of these coils is twenty-eight tons divided between 13,000 lineal feet of steel tubing and 14,000 lineal feet of seamless copper tubing. The total refrigerated space is 130,000 cubic feet, being divided approximately, 55% air cooled for fruit cargo, 30% for brine coil cooled meat or vegetable cargo, and 15% ship stores refrigeration. There is also water cooling for passengers and crew, and ice making.

Our facilities enable us to fabricate any size or shape of coil in iron, steel, brass, copper, nickel or monel pipe. Write for quotations.

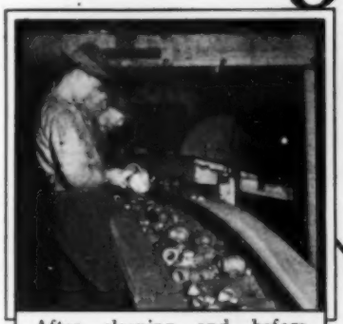
THE NATIONAL PIPE BENDING CO.
140 River St., New Haven, Conn.
Boston New York Philadelphia



There were four sets each of steel and seamless copper tubing coils fabricated by National for the S/S Virginia. Part of the order shown en route with end view of one set of coils.

ACCURACY *of Inspection*

Every possible human and mechanical means insures accuracy in Stockham manufacture. But to insure complete satisfaction that results from accurate threads, chamfered faces, smooth inner and outer surfaces, fine finish, soundness and strength, Stockham Fittings are constantly inspected and tested. Over 7500 patterns in the Stockham line enable you to use Stockham Fittings to save your time and money on every job.



After cleaning and before tapping all fittings are inspected for soundness

Regular, accurate checking of depth of threads as every size is tapped

After galvanizing, all Stockham Fittings are carefully inspected for finish

Stockham Fittings are constantly checked for accuracy of alignment

Final inspection for Stockham quality, appearance, good threads, soundness and finish

Before shipment, all Stockham Fittings receive a final inspection and check

Stockham accuracy saves time and money in the process industries, where accuracy in pipe line installations and repairs is so necessary to production. Catalog on request. Stockham Fittings are sold by leading wholesalers throughout the country.

STOCKHAM PIPE & FITTINGS CO.
BIRMINGHAM, ALA.

Warehouses
BOSTON NEW YORK CHICAGO LOS ANGELES

CAST IRON
Screwed *Flanged* *Drainage*

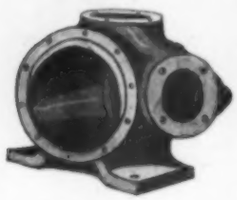
MALLEABLE
Standard *Extra Heavy*
Oil Country Malleable

ELECTRIC CAST STEEL
Flanged *Screwed*

STOCKHAM FITTINGS

Cut costs with Blackmer pumps

5 reasons why Blackmer *always* pumps more gallons at less cost



Cylinder — none better made

Rotor, in which buckets are hung

Buckets which automatically and continuously compensate for wear on cylinder

Every Blackmer pump embodies the principle of hydraulic balance, an exclusive Blackmer feature.

Blackmer rotary pumps handle more gallons with less power than any piston pump made, because of the continuous rotary action which gives a steady, constant flow of liquid.

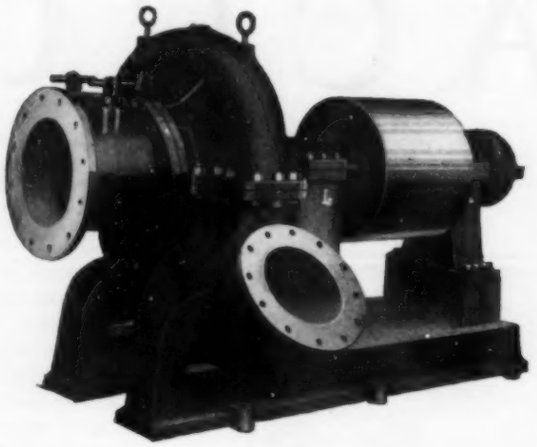
Blackmer pumps retain their original operating characteristics throughout their life, due to the Blackmer principle of "continuous take-up for wear" which allows the pump automatically to adjust itself as wear occurs. Our pumps give, therefore, exceptionally long life of efficient and economical service.

BLACKMER ROTARY PUMPS

Quickly, easily, economically serviced. When a Blackmer pump shows signs of wear, it is only necessary to replace the inexpensive parts, the buckets and the pump is made new again, ready for another long period of trouble-free service.

We would like to show you the advantages of using Blackmer pumps, either with or without liners, as your need may be. Write today.

BLACKMER PUMP Co.
1808 Century Avenue
GRAND RAPIDS, MICHIGAN
Offices in Principal Cities



Your heavy stock easily handled with this "Buffalo" Non-clogging Pump

"Buffalo" Non-clogging Stock Pumps, made for either belt or motor drive have been found unexcelled in the process plant where unusually heavy stock or liquid is handled.

They are built in several different types, making it possible to choose the one that fits each particular process; Single Suction with horizontally divided casing—Single Suction with solid casing and removable side plates—and Single Suction "raw sewage" type to handle extremely large solids.

Let us know the kind of solids you are handling and we will send you complete particulars on the "Buffalo" Non-clogging Pumps that will do the job properly.

Write today—No obligations.

Buffalo Steam Pump Co.

492 Broadway, Buffalo, N. Y.

Amarillo, Birmingham, Boston, Chicago, Charlotte, Cincinnati, Cleveland, Detroit, Dallas, Los Angeles, Minneapolis, New Orleans, New York, Omaha, Pittsburgh, Philadelphia, San Francisco, Seattle, St. Louis, Toledo, Washington

In Canada:
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Pumps for Every Process

TO FIGHT CORROSION

"WAKEFIELD AMALGAMATED" lead-lined products

The Lead and Iron cannot be separated.

A Permanent Amalgam

is obtained by our own, exclusive method of fusing metal and lead lining for a homogenous, perfect bond. It means a *permanent installation.* This explains why the country's greatest concerns who buy on *quality*, invariably specify "WAKEFIELD AMALGAMATED." Some "Wakefield" installations have been in service over 30 years. Today they are practically as good as new!

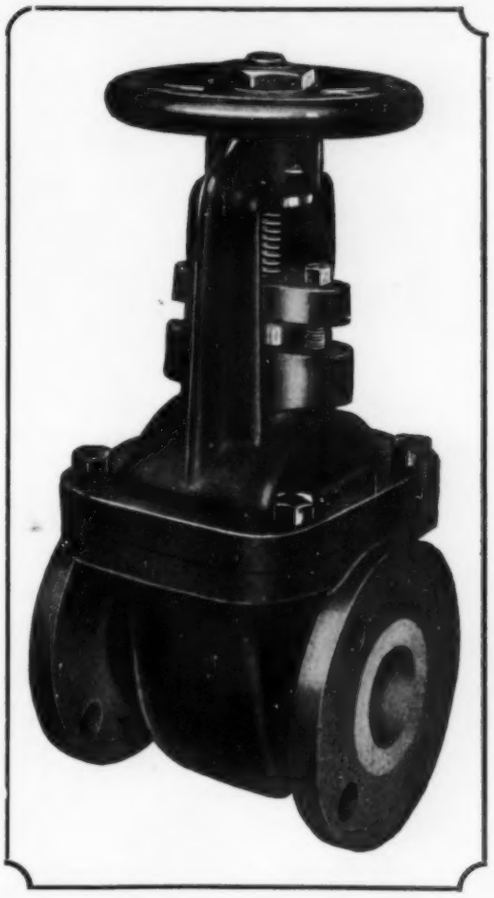
Our sales engineering force, with the Industry's largest experience behind them, are willing and qualified to relieve you of your Piping and Equipment problems. Do not hesitate to address—

LEAD-LINED IRON PIPE CO.

Established 1891

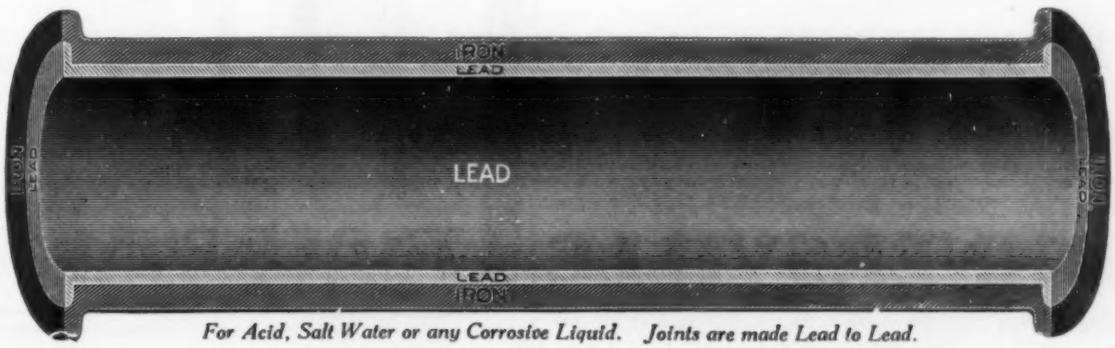
Wakefield, Mass., U. S. A.

Pioneers and Leading Manufacturers of Lead-Lined Equipment



Lead-Lined or Block Tin-Lined "Amalgamated" Acid-Resisting

Pipe	Tanks
Fittings	Coils
Valves	Tubes
Stop Cocks	Special Apparatus



For Acid, Salt Water or any Corrosive Liquid. Joints are made Lead to Lead.

Pumping liquids without "racing"

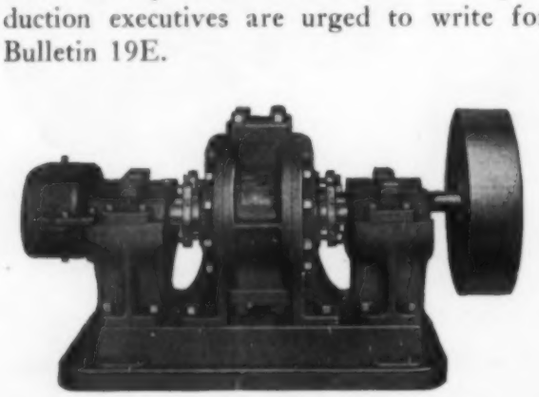
Positive, continuous pumping of liquids is always far easier on the equipment, and in the long run, handles larger volumes than do pumps that cannot maintain this positive action, frequently tending to "race."

This positive, constant type of operation is one of the advantages in a rotary motion Connersville Cycloidal Pump. This rotary motion eliminates the return stroke and clearance space, where the stroke is first in the zone of suction and then in the zone of discharge, and which causes racing when some pumps are handling very light and hot liquids.

Other engineering features of the Cycloidal Pumps are their simplicity and the absence of small parts such as valves, springs, buckets, liners, or internal packing.

Due to the two-impeller design, these Connersville Cycloidal Pumps can move gases and liquids simultaneously.

The range of processes where these pumps serve is very wide. Process men and production executives are urged to write for Bulletin 19E.

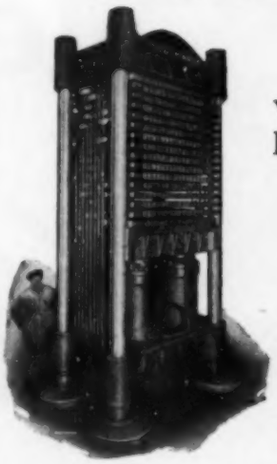


The Connersville Blower Co.
Columbia Ave. at 12th St.
Connersville, Indiana

SALES OFFICES
114 Liberty St., New York — 1434 Monadnock Block, Chicago — Chamber of Commerce Bldg., Pittsburgh

CONNERSVILLE
Blowers · Gas Pumps · Meters · Cycloidal Pumps

SOUTHWARK
HYDRAULIC PRESSES
Types to suit every operation
SPECIAL MACHINERY



Hydraulic Pumps, Accumulators, Valves, Fittings etc., Hydraulic Presses for every purpose.

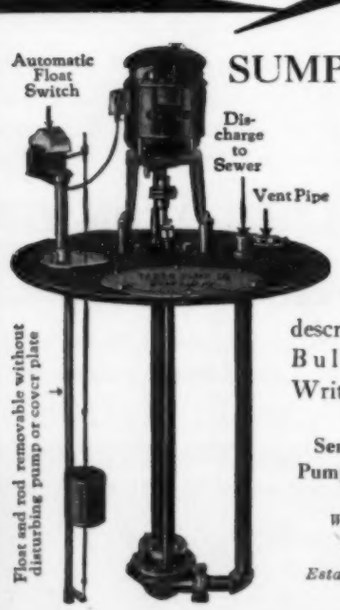
Special machinery designed and built to suit requirements.

The illustration at the left shows a four-cylinder steam platen press of 800 tons capacity. Used for moulding and curing rubber, bakelite, fibre, shellac compositions and other plastics.

ESTABLISHED
1836

SOUTHWARK
FOUNDRY AND MACHINE CO.
400 Washington Avenue
Philadelphia, Pa.

TABER PUMPS



SUMP PUMP

Here is a sturdy pump for many uses. Fig. 1162, illustrated, is described in our Bulletin SP. Write for it.

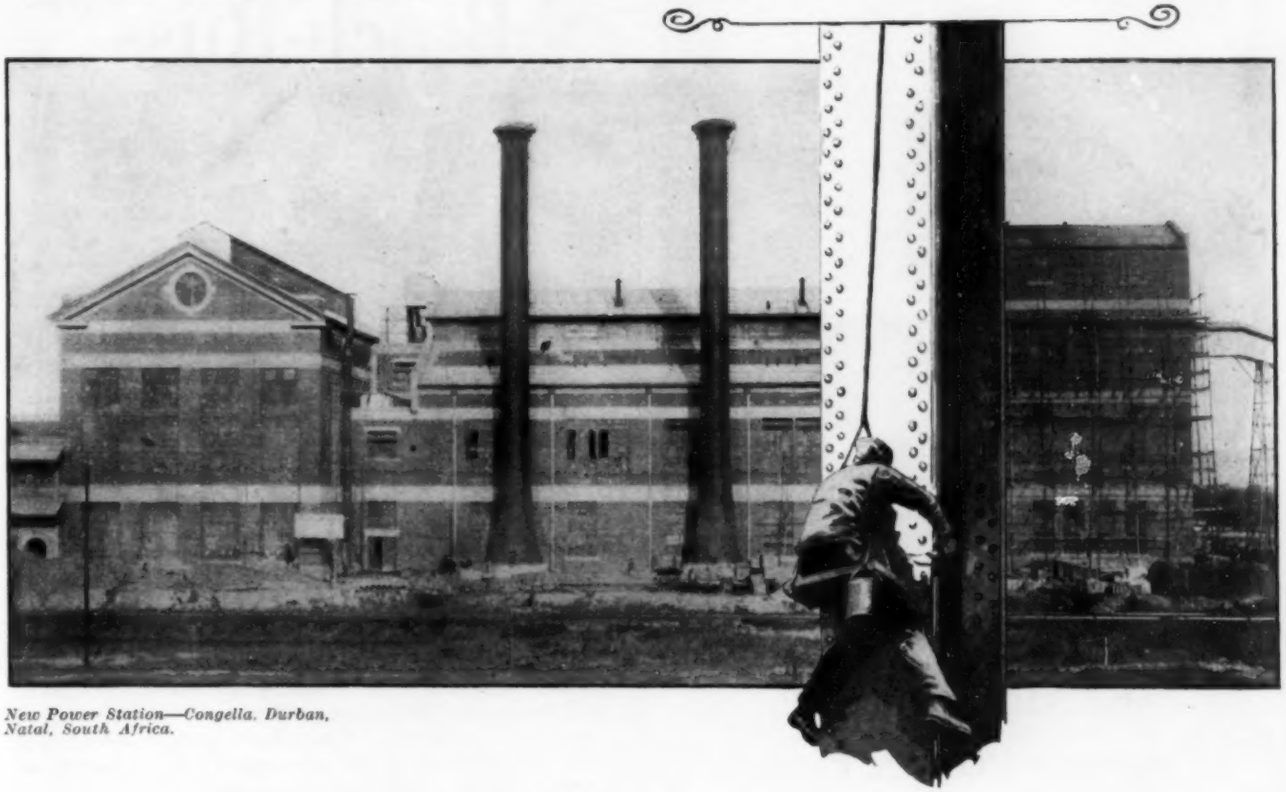
Send Us Your Pumping Problem

We are pump specialists.

Established in 1859

TABER PUMP CO.
BUFFALO, N.Y.

SERVICE DATA FOR PROTECTIVE PAINT USERS - - - - - - CASE NO. 9



New Power Station—Congella, Durban, Natal, South Africa.

World wide recognition . . . Dixon's **Paint**

At Natal, South Africa, an internationally known engineering organization (name on request) recently completed the power plant shown above. The stacks were protected with Dixon's Silica-Graphite Paint—a logical choice by these engineers due to their intimate knowledge of the service this paint had given their organization in the United States and elsewhere throughout the world.

For the fame of Dixon's Silica-Graphite Paint—10 . . . 12 . . . 15 . . . and even 20 years of active protective life under varying degrees of severe service conditions is not confined to the United States. The Air Ministry and Admiralty of England as well as many of her representative industrialists, railroads and municipalities specify it. India, Chile, Bolivia, Argentine, the Philippine Islands, South Africa, Brazil, in fact throughout the world, bridges, power plants, iron and steel structural work, tanks, train sheds and industrial buildings are protected from rust, corrosion and process deterioration by this unusual protective paint.

Yes, Dixon's comes in several serviceable colors

Many people think of Dixon's Silica-Graphite Paint as unattractive. Actually it gives a fine durable semi-gloss finish, and it may be had in three tones of gray, dark red, green and black. There is also Dixon's Aluminum Graphite Paint for a silver-gray heat-reflecting finish.

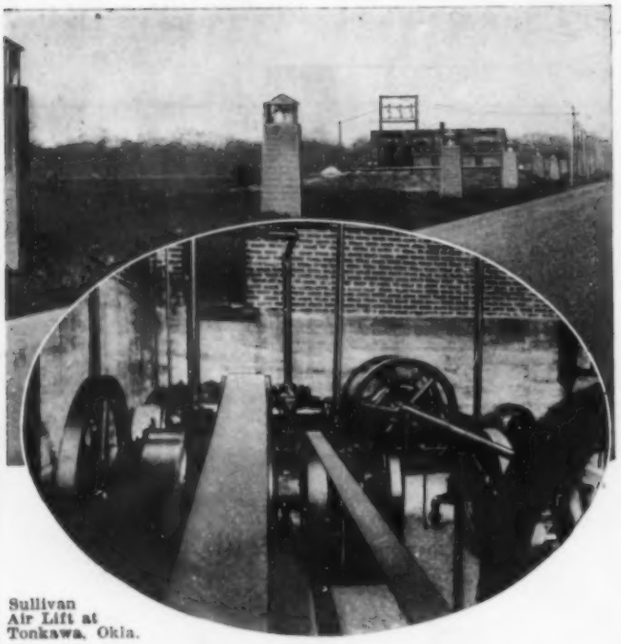
JOSEPH DIXON CRUCIBLE COMPANY
JERSEY CITY, NEW JERSEY
Established 1827

D X N TRADE MARK

Our booklet No. B-243, in addition to a complete discussion on the physical and protective properties of Dixon's Silica-Graphite Paint, gives also an impressive list of users throughout the world. Know its protective qualities, its uses and its users by sending for your copy today!

DIXON'S SILICA GRAPHITE PAINT

Adequate Protection at Minimum Ultimate Cost



Sullivan
Air Lift at
Tonkawa, Okla.

Can the Gallons-per-Minute be Maintained?

Scores of Pumping Plants Now Say "Yes, with Sullivan Air Lift"

When your wells slow up—there is usually plenty of water available.

But sand has packed around the screen and reduced the inflow—or it has worn the mechanical pumps so they do not carry a full load of water.

Both of these difficulties are overcome by the Sullivan Air Lift System and "Air Made" Wells. Sand is removed from the well and replaced by coarse gravel. And there are no moving parts in the well to be damaged by sand. Scores of these wells have been installed where other wells went dry. And in every instance the Sullivan Well maintained or increased its production.

At Tonkawa, Oklahoma, ten of these wells doubled in flow in two years, while other wells all around them were abandoned. At Chandler, Oklahoma, one "Air Made" Well produced more water than forty mechanical wells previously used.

Greensburg, Kansas, replaced four drilled wells and one dug well (32 ft. in diameter and 96 ft. deep)—with one 8-inch Sullivan Air Lift Well.

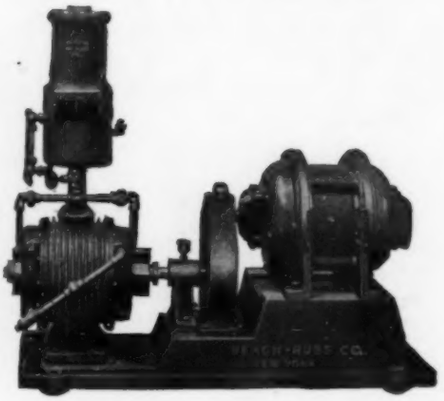
Amarillo, New Boston, Teague, Clarendon, DeKalb, Mt. Vernon, Midland, and Sweetwater, Texas—Faunsdale, Alabama—Concordia, Greenleaf, and Lewis, Kansas—Earlsboro and Hooker, Oklahoma and scores of other cities have solved the problem of wells slowing up, with Sullivan Air Lift.

Sullivan Air Lift will give you "dependable water supply anywhere." Why not send for Catalogs 71-ICM, and 56-JCM?

Sullivan Machinery Company
Adams St. and Michigan Ave., Chicago

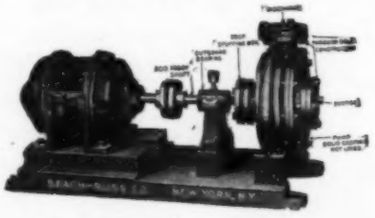
SULLIVAN TRADE MARK

Beach-Russ



Rotary Pump
High Vacuum Guaranteed

Guaranteed to exhaust to within ¼" of barometer, the Beach-Russ Patented Rotary Vacuum Pump enjoys a wide usage. All units are small and compact in design, simple in construction, silent in operation. The above unit is also built in a compound type, guaranteed to exhaust to within 1 mm. of perfect vacuum.



Acid Resisting Pump

Constructed in lead and antimony alloy, monel metal, bronze and aluminum to suit various kinds of work; cast solid, not lined; the Beach-Russ Acid Resisting Pump will give unlimited service. Single Stage, Side Suction, open impeller type with through bolt construction. These pumps were designed for pumping both diluted and heavy solutions of sulphuric acid. Made in capacities from 20 to 200 gals. per minute.

For complete information on Beach-Russ Liquid Pumps, Rotary Air Compressors or other units listed below, write for catalog.

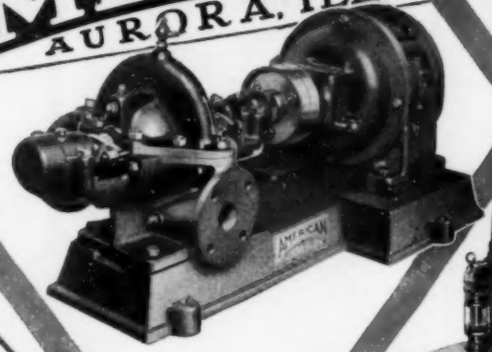
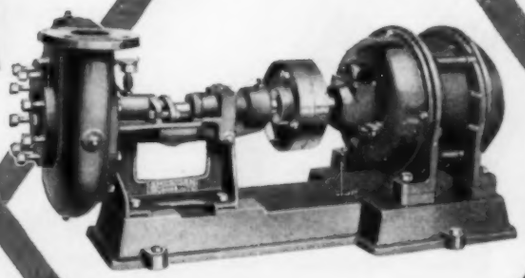
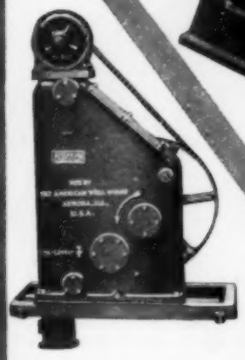
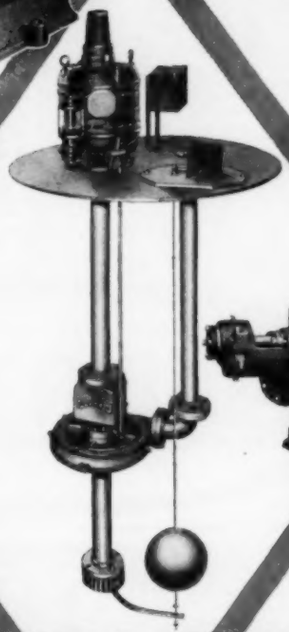
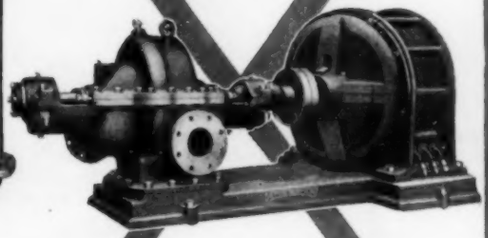
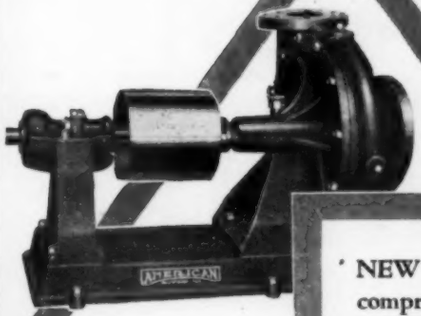
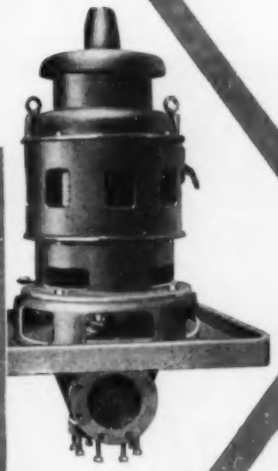
Rotary Air Compressors
Finishing Pumps
Acid Resisting Pumps
Vacuum Pump for Automatic Feeds
Gas Boosters
Liquid Pumps
Heating Pumps
Pressure Blowers
Pulverizing, Grinding and Mixing Equipment

Beach-Russ Co.

42 Church St., New York, N. Y.
Cortlandt 0054

BOSTON CHICAGO BUFFALO LOS ANGELES BALTIMORE PHILADELPHIA
Busfield, McLeod, Ltd., Montreal, Canada

AMERICAN
AURORA, ILL.

NEW CATALOGS containing complete, comprehensive data on "American" centrifugal pumps, plunger pumps, and deep well power heads are now available. An engineering organization—the outgrowth of over half a century of experience in the design of pumping machinery—is at your disposal for consultation with your engineers.

As manufacturers of a complete line of pumping equipment, The American Well Works sales organization is in a position to impartially recommend the ideal pump for the job.

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CHICAGO, ILL....1615 FIRST NAT'L BANK BLDG.

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Typically ALDRICH

ALDRICH PUMP DESIGN

emphasizes: Positive Balance Action

Thorough Bearing Protection
Maintained High Efficiency

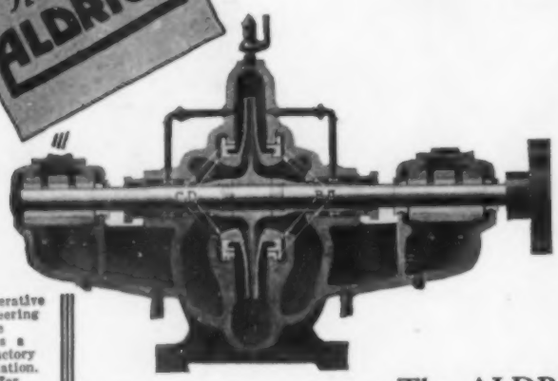
Those three qualities stand out in first importance where pumps play a vital part in continuous service. The special Aldrich balance feature (illustrated at left) forms an automatic "centering" device, eliminating all wear due to the end thrust of the shaft. Special oil rings prevent oil dilution and prolong bearing life.

All parts are interchangeable and pump can be knocked down and reassembled very quickly.

Single Stage and Multi Stage types, covering the whole field of Centrifugal pump practice. Data 71.

(Bronze and special alloys if desired).

Data 70 (16 pages) sent on request.



A, B, C, and D show the "balance" parts.

If thrust tends to force the rotor to one side, pressure builds up on that side and reduces on the opposite side, tending to prevent the movement. This alternate action maintains the rotating element in a virtually central, free running position, independent of pressure variation.

Co-operative engineering service insures a satisfactory installation. We offer you this service.

Investigate Kosmos Porcelain Plungers for Permanent Plunger investment —Data 57.

The ALDRICH PUMP Company
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Standardized PUMPS for Specialized Industries

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De Laval Pumps

Keep the Plant Running

THIS De Laval Single Stage Pump is handling "white water" in a large paper mill, 24 hours per day, year in and year out. It is built in the regular De Laval manner, from the best of materials and with the highest grade workmanship, on a limit gage, interchangeable basis throughout. Parts exposed to wear are made of bronze, or protected by bronze wearing rings, sleeves, bushings, etc. Any ordinary workman can insert renewals when required, as they do not have to be fitted. Each De Laval Pump is guaranteed as to head delivery, efficiency and other characteristics, and is thoroughly tested before it leaves our Works.

State requirements and ask for Catalog B.

De Laval Steam Turbine Co., Trenton, N.J.

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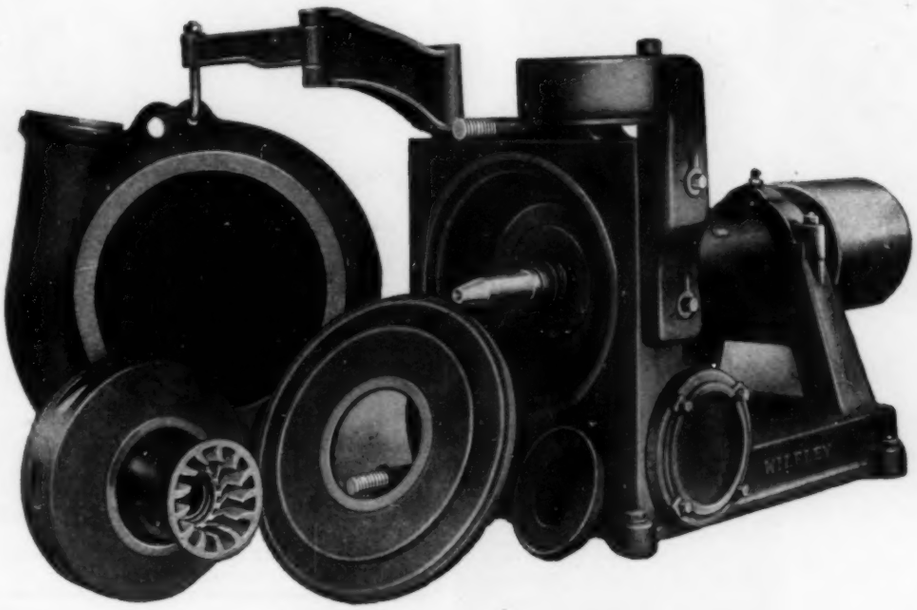
WILFLEY
PUMPS



CENTRIFUGAL SEAL
instead of STUFFING BOX

The "Wilfley" patented centrifugal seal that has done away with the troublesome stuffing box, is one feature that alone is worthy of every operator's consideration.

Described and illustrated in our catalog No. 6.

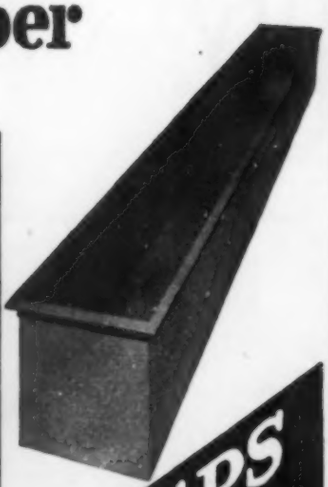
WILFLEY Centrifugal SAND PUMP
PATENTED

A. R. WILFLEY & SONS, Inc.
DENVER, COLO., U. S. A.

ACE Hard Rubber for

TANKS

All sizes, shapes, capacities. Solid ACE Hard Rubber or ACE Hard Rubber tank lining.



PUMPS

Centrifugal, reciprocating, gear, single and double acting. Hand, Belt, Steam and Electric Drive. Capacities 6 to 200 gallons per minute.

PIPE

A complete line of threaded ACE Hard Rubber Pipe from ¼ to 4" diamter. Larger sizes to order.

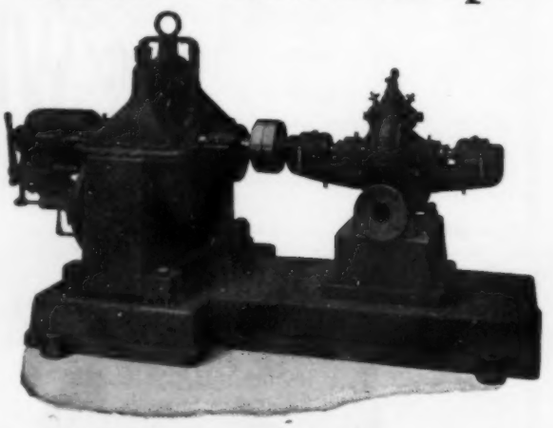
and fittings

AMERICAN HARD RUBBER COMPANY

11 Mercer Street, New York, U. S. A.

Manufacturers of RADION—*The Supreme Insulation* for short wave, high frequency currents

Filter Press Pumps



The type SP pump illustrated has been designed especially for handling scums, filter press aggregates, and liquors of like consistency containing more or less solids in suspension.

Fairly high pressures are attained with the type SP.

If you have a difficult filter press pumping problem, or one involving the handling of heavy scums, or juices, we think the type SP is the answer. At any rate we'd be glad to tell you what this pump will do on your work.

Please tell us what you are pumping, its temperature, the total capacity desired, the net operating head, and how you expect to drive the pump.

DAYTON-DOWD

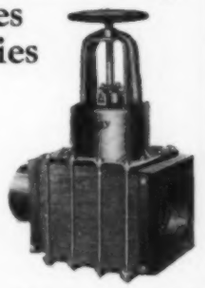
CENTRIFUGAL PUMPS

Quincy, Ill. *Sales Offices in 51 Cities*

Murray Acid-Resisting

All-Wood and Lead Lined Pumps Gates and Check Valves for the Process Industries

This equipment should be at once investigated by you if you have a problem of handling acids or chemicals that are corrosive. Besides items shown we make Acid-Resisting Bronze Pumps.

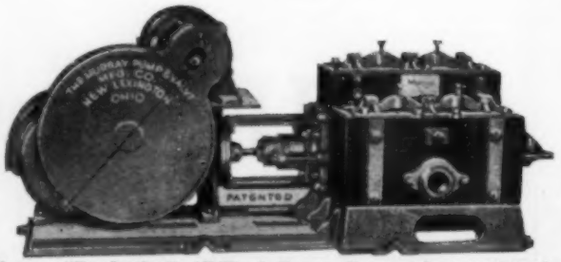


Murray All-Wood Valves, up to 50 lbs. pressure. We also furnish Lead-and-Wood Lined Valves up to 150 lbs.

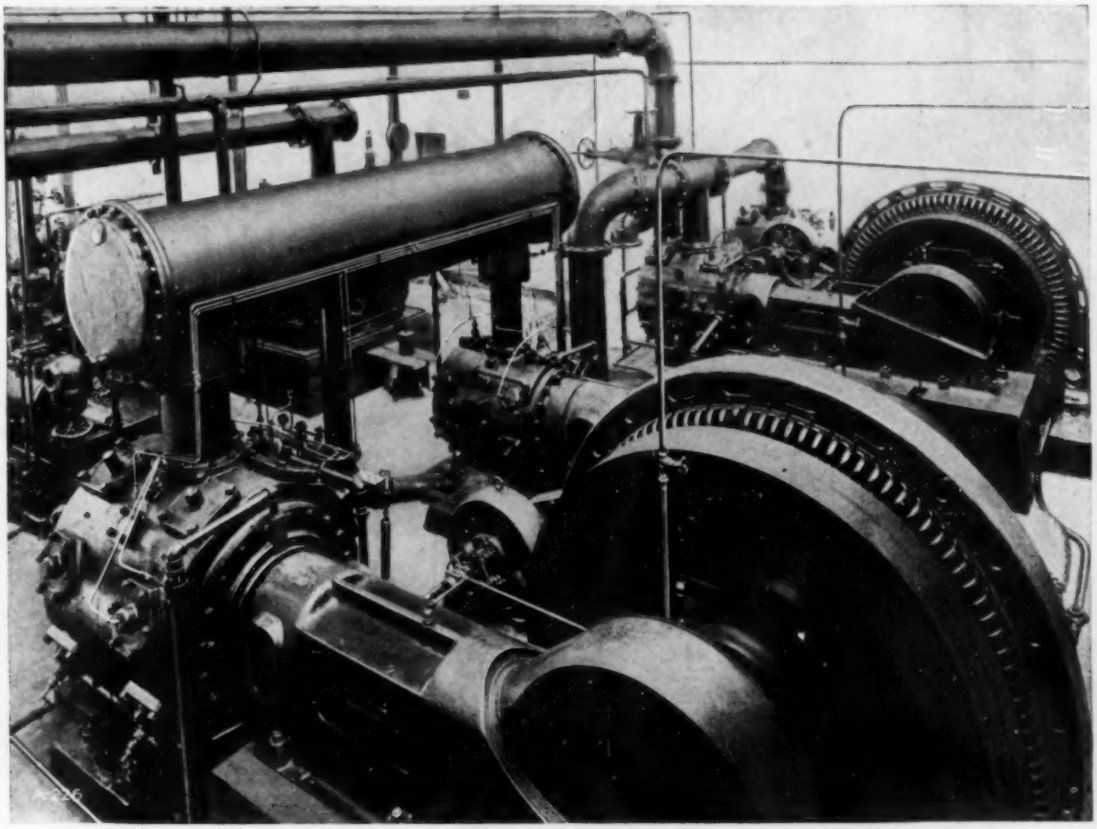
Est. 1908. *Send for folders.*

The MURRAY PUMP & VALVE MFG. CO.

New Lexington, Ohio



Murray "Everlasting" All-Wood Pump—For wood or metal pipe connection. Self-oiling Timken bearings.



Worthington synchronous motor driven 26½/16x18 two-stage, and 20x14 duplex, Air Compressors at Draper Corporation Plant, Hopedale, Mass.

Air Compressors . . in oil furnace and general service, Hopedale, Mass.

TWO Worthington FEATHER (Reg. U. S. Pat. Off.) Valve Air Compressors, direct synchronous motor driven, are used by the Draper Corporation, Hopedale, Mass., manufacturers of cotton machinery. A duplex type compressor with a capacity of 2180 cu. ft. per min. at 25-lb. pressure is used for oil furnace work; a two-stage type with a capacity of 1965 cu. ft. per min. at 100-lb. pressure supplies compressed air for general manufacturing service.

Both of these compressors, as usual with Worthington equipment, are giving excellent service. How may Worthington serve you?

WORTHINGTON

PRODUCTS

PUMPS
COMPRESSORS
CONDENSERS *and Auxiliaries*
OIL *and* GAS ENGINES
FEEDWATER HEATERS
WATER *and* OIL METERS

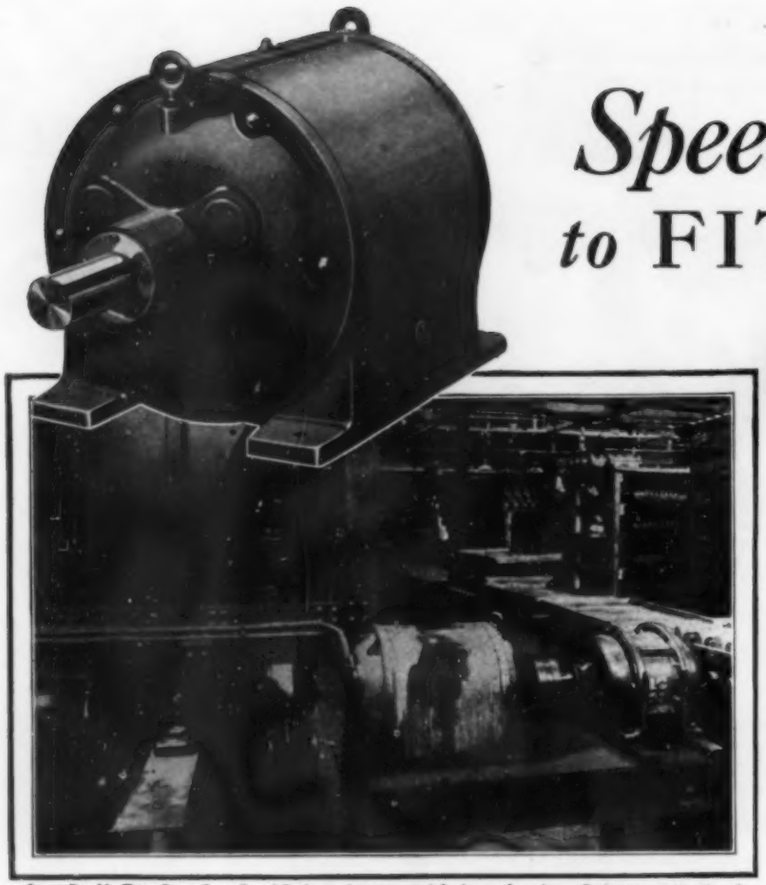
Literature on Request

WORTHINGTON PUMP AND MACHINERY CORPORATION. 2 PARK AVENUE. NEW YORK · DISTRICT OFFICES IN 24 CITIES

WORTHINGTON

6241-7

THE *Speed Reducer* *to* FIT *Your Needs*



Jones Double Type Spur Gear Speed Reducer driving sand feeder in foundry. Reduction ratio 60 to 1

Jones Heavy Duty Worm Gear Speed Reducer driving feeder conveyor in paper mill. Reduction ratio 69 to 1

J Your speed reduction requirements can be efficiently and economically met with either a Jones Spur Gear Speed Reducer or a Jones Worm Gear Speed Reducer. Both are made in a variety of sizes to meet almost any requirements.

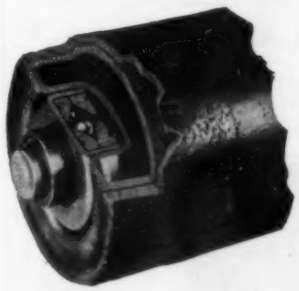
Let our engineers help you in working out the best solution to your speed reduction problem. They will be glad to serve you and to advise you impartially.

The many natural economies of the enclosed speed reducer drive—such as lower installation cost, space-saving, safety, lower operating costs, greater power efficiency, freedom from repairs and shut-downs—are further enhanced by the correctness of Jones design, accuracy of Jones workmanship and quality of Jones materials. We shall be glad to have you write us.

W. A. Jones Foundry & Machine Company
Main Offices and Works:
4416 W. Roosevelt Road, Chicago, Ill.
Branch Sales and Engineering Offices:
New York, Cleveland, Milwaukee, Pittsburgh, Buffalo, Detroit, Birmingham, St. Louis, Cincinnati, Peoria, Los Angeles, San Francisco

SPUR AND WORM GEAR
Jones Speed Reducers

Built-in Service



"Built to Fit the Job"

Our Gravity Roller Conveyor can be furnished with Through Shaft ball bearings for shaft, sizes ranging from 5/16" to 1-1/8" and with bearing construction in proper proportion.

Where conditions only require a bearing with shaft size of 3/8" we are not compelled to use a 1/2" and where a 13/16" shaft is required we have it to use and do not have to skimp through with a 3/4 inch.

That's the answer

Long service records for Standard Conveyors with freedom from constant maintenance troubles is due to the construction. Such built-in service eliminates any possibilities of slow movement in handling both raw materials and the finished product. Such built-in service is the answer to why manufacturers using Standard Conveyor Systems have been able to reduce their net handling costs, saving as high as 85% over old handling methods.

Let our Conveyor Counselors help you in solving your handling problems. Possibly they can show you where you can save money throughout your present handling system.

STANDARD CONVEYOR COMPANY

NORTH SAINT PAUL, MINNESOTA

New York, 420 Lexington Avenue
Chicago, 549 West Washington Street
Philadelphia, 3110 Market Street
Cleveland Office, 819 Hippodrome Building
Buffalo, 908 Ellicott Square

Kansas City, 419 Manufacturers' Exchange Building
Milwaukee Office, 209 W. Wisconsin Ave.
Los Angeles, 335 South San Pedro Street
Seattle Office, 321 Lumber Exchange Bldg.
Charlotte Office, 301 Builders Bldg.

ON the top of each one of these ten tar stills is a Series 1400 Vertical Type Worm Gear Speed Reducer driving a tar still agitator. The ratio is 40 to 1, 5 H. P. at 1200 r.p.m.

This company, which operates one of the most modern plants of its kind specified Horsburgh & Scott Vertical Type Worm Gear Speed Reducers on account of their many exclusive features.

Write for bulletins and literature describing these reducers in detail.

Drive It With Gears

The Horsburgh & Scott Co.

5114 Hamilton Ave. *"Gear Makers Since '89"* Cleveland, U. S. A.

Gears for Every Industrial Purpose—Worm—Bevel—Herringbone—Spur—Spiral—Hardened Heat Treated Gears—Non-Metallic Gears and Pinions

Handy as a Dozen Workmen

Dependable as a Permanent Conveyor

IN considering portable conveyors, look at them from two sides—the operating and the upkeep.

True enough, the initial cost of any portable conveyor is relatively low and maintenance itself may not be much in dollars and cents. But, maintenance can be a nuisance.

Robins Portable Conveyors have all the handiness and adaptability desired. In addition—they are built with many features identical with those on Robins fixed conveyors—and low maintenance is a feature of Robins Conveyors.

Get all the details from our nearest office. Have them at hand when you need a portable conveyor.

ROBINS CONVEYING BELT COMPANY

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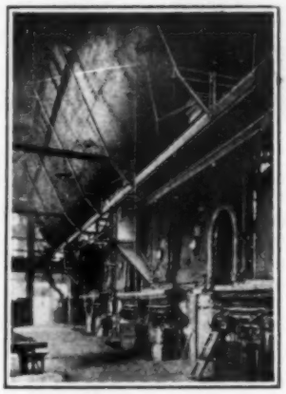

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equipment for the power plant

Weigh Larries — Skip Hoists
Perkins pivoted Bucket carriers — Coal Bunkers and Spouting
Coal Crushers — Bucket Elevator
etc., etc.

Our Engineering Department is At Your Service

THE WEBSTER MFG. COMPANY

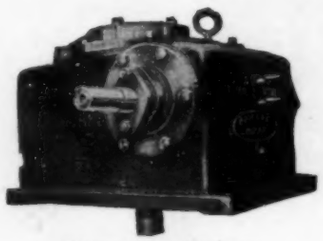
1036 N. Kostner Ave., Chicago, Illinois

Industrial Hours Slipping away—

—while a faulty Speed Reducer is fixed—

A gear breaks—a bearing burns out—a shaft is distorted—the Speed Reducer was bought on a PRICE basis.

Philadelphia
SPEED REDUCING UNITS



Worm Gear Reducer Type V.X.

PHILLIE GEAR

Power Saving Products

GEARS, Spur, Worm, Herringbone, Internal, Bevel, Miter, Intermittent, Spiral, Helical.

NON-METALLIC PINIONS: Fabroil, Textolite, Rawhide.

Whitney Silent and Roller Chains, Sprockets, Flexible Couplings, Universal Joints, Racks, Ratchets and Pawls, and a complete line of gear driven

SPEED REDUCING UNITS

MEMBER OF AGMA

are produced under never-ceasing inspection

If you could see with what care their gears are heat treated—how threads on worm shafts are first hardened then ground—how carefully shafts are machined and ground—how roller bearings or bronze bushings are provided and protected against dust and dirt—you would realize why experienced men responsible for keeping things going insist on Philadelphia Units. The mere fact that we never get orders for repair parts of these units is significant.

Philadelphia Speed Reducing Units are made in ALL TYPES (Spur, Worm, Herringbone, Spiral Bevel Herringbone)—for all drives—all ratios—hp. up to 250.

Write for descriptive Bulletins.

Main Office and Plant Erie Ave. and G St. Phila., Pa.

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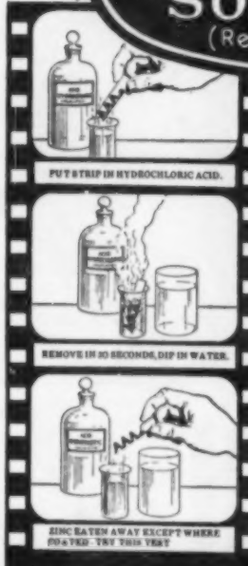
Manufacturers of Industrial Gears and Speed Reducing Units

PHILADELPHIA, PENNA.

Branch Sales and Engineering Office: 12 E. 41st St., New York

Prevent Corrosion with
ANTI ACID AAA ALKA QUA
SOLUTIONS
(Reg. U.S. Pat. Off.)



Will Your Paint Stand This Abuse?

Triple-A Solutions are made to protect steel and concrete from the corrosive action of acid, alkaline and moisture. They adhere firmly (specially where ordinary paints peel off) and fill every crevice and pin hole, seal the surface tight and, form a permanent barrier against the destructive influence of corrosion.

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Triple A is a Quigley Product

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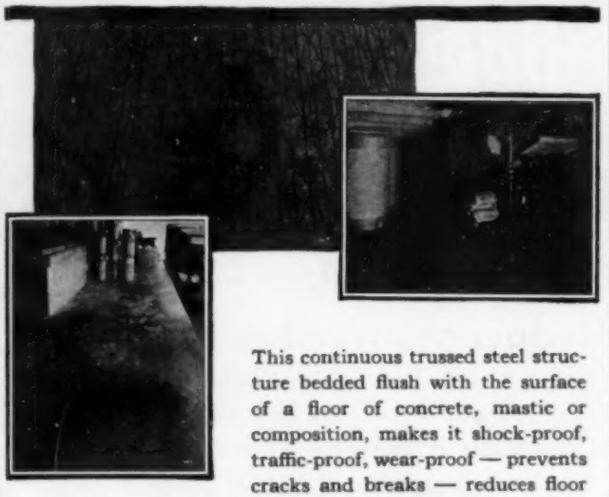
INCORPORATED
26 CORTLANDT ST. NEW YORK

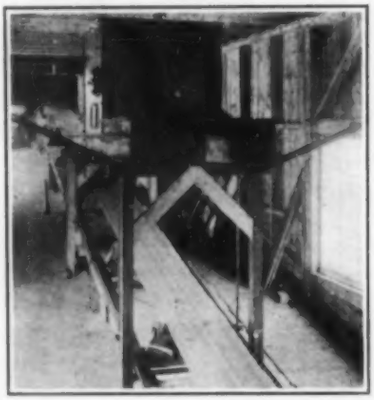
IRVING CONTINUOUS FLOOR ARMORING



This continuous trussed steel structure bedded flush with the surface of a floor of concrete, mastic or composition, makes it shock-proof, traffic-proof, wear-proof — prevents cracks and breaks — reduces floor upkeep to a negligible figure. Write for Bulletin K-1.

IRVING IRON WORKS CO.
LONG ISLAND CITY, N.Y. U.S.A.
Established in 1902

Weigh While You Convey
over
THE MERRICK CONVEYOR WEIGHTOMETER



Any material which is conveyor-handled can be weighed without additional handling or loss of time by the Merrick Conveyor Weightometer.

An Automatic—Continuous—Accurate Record

MERRICK SCALE MFG. COMPANY
186 Autumn St., Passaic, N. J.

PLAIN STATEMENTS
of Scale Users
in the Process Industries

A leading
Food Products Company*
tells its story:

"The Buffalo Scale which we have is one of the largest scales in Newark and many of the largest trucks come down here to do their weighing. We are using them continually ourselves and have experienced no trouble whatever, and in fact, are 100% satisfied with them."
*Name on request.

BUFFALO SCALES
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BUFFALO SCALE CO., Inc.
1218 Niagara St., Buffalo, N.Y.

All Sizes and Types of beam scales from 1/100th of an ounce to 300 tons

You Can Eliminate Shut-downs for Coupling Repairs by Replacing old type Flexible Couplings with Fast's Self-Aligning Couplings

ONCE or twice in every generation a new mechanical principle sweeps in, revolutionizing current practice. That is exactly what has happened to flexible couplings.

Heretofore it was accepted as axiomatic that a flexible coupling had to be built with flexible materials. But eight years ago Fast's design cast aside all flexible materials and eliminated replacements forever.

No More Replacements

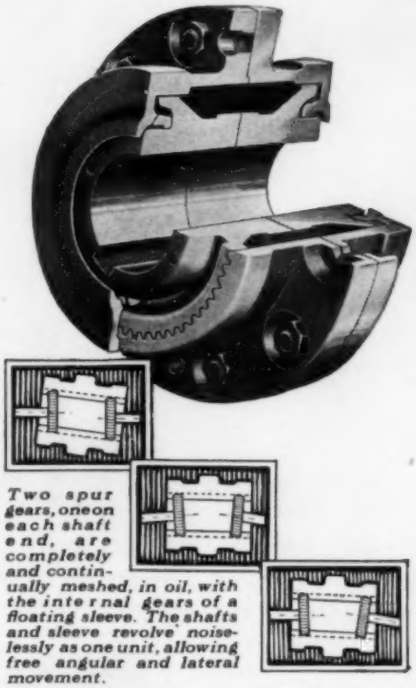
There are today thousands of plants that carry replacement parts to repair broken pins, bushings, springs, discs or grids in old type flexible couplings. But there are thousands of other plants that have written couplings off the replacement list forever, by standardizing on Fast's Couplings without flexible materials.

Note the Principle

See diagram above. Read the explanation. See how this simple principle of a floating sleeve compensates for lateral and angular misalignment, by distributing the error between the lubricated tooth faces of generated gears. Simple, isn't it? And because of its very simplicity it will solve your coupling problems.

What is Your Problem?

It makes no difference whether your coupling failures occur on small pumps or fans; or on main units in power plants, or on huge steel-mill reversing drives—in any case, hanging over your head is "shut-down for coupling repairs" unless you do away with flexible materials, and thus do away with shut-downs. Fast's Coupling is the answer.



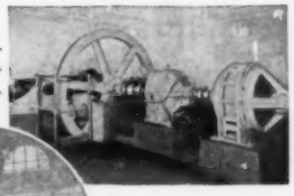
Two spur gears, one on each shaft end, are completely and continually meshed, in oil, with the internal gears of a floating sleeve. The shafts and sleeve revolve noiselessly as one unit, allowing free angular and lateral movement.

FAST'S
Self-Aligning
COUPLING
Without flexible bushings, pins, springs, discs, grids or any other flexible materials.
Patented and Manufactured by
The BARTLETT HAYWARD Co.
BALTIMORE, MARYLAND

Send for the Book

Here is a book that tells the whole story—from both a practical and an engineering standpoint. It clearly illustrates Fast's principle of mechanical flexibility and centrifugal lubrication. It also gives the mathematics of design for the engineer who is interested in how misalignment is "divided by 10" and practically eliminated before it gets to the gears.

Also the book shows typical installations, coupling ratings, and utility factors for all varieties of drives. Write today and see how this coupling can eliminate from your plant, forever, the now costly shut-downs for coupling repairs.



General Motors Building, Detroit.

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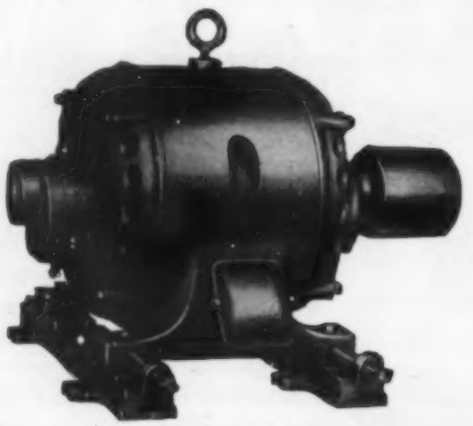
"They Keep a-Running"



7½ Horse Power Century Type SC Squirrel Cage Induction 3 and 2 Phase Motor

There is a Difference!

You cannot judge a motor by looking *at* it. You must look *into* every part of it...If you investigate Century Type SC Squirrel Cage Induction 3 and 2 Phase Motors, you will find a well-balanced design, durable, substantial and accurate construction, proper allocation of all active materials and many other points of decided difference that make them highly desirable wherever continuous service is essential.

The armatures of Century Type SC Squirrel Cage Induction 3 and 2 Phase Motors are practically indestructible. They possess the most desirable electrical characteristics.

Century Type SC Squirrel Cage Induction 3 and 2 Phase Motors are built in standard sizes from ¼ to 200 horse power.

CENTURY ELECTRIC CO.

1806 Pine St. *St. Louis, Mo.*

34 Stock Points in the United States and more than 50 outside thereof

¼ to 200 H. P. Century MOTORS ¼ to 200 H. P.

VENTILATION—
At the Maximum With Mitco Interlocked Steel Grating

In Mitco Interlocked Steel Grating, there are no acute angles to clog and thus restrict ventilation and light.

Instead, Mitco has rectangular openings. Each panel surface is 90% *open area!*

With Mitco, maximum light and ventilation are provided, plus high strength, rigidity and freedom from deflection. Truly, Mitco is the ideal steel flooring. Specify it on every job.

We shall be glad to send you a copy of the new Mitco bulletin, if you will write.

HENDRICK MANUFACTURING CO.

53 Dundaff Street, Carbondale, Pa.
NewYork Office: 15 John St.,'Phone Cortlandt 2440
Pittsburgh Office: Union Trust Building
Chicago Office: Railway Exchange Bldg., 'Phone Wabash 5768

Offices in Principal Cities. Consult Telephone Book

Makers of Mitco Shur-Site Stair Treads, Mitco Armorgrids and Hendrick Perforated Metal Screens

MITCO

INTERLOCKED STEEL GRATING

The Grating With Every Advantage

Strength—Permanent Rigidity

Non-Slipping, Non-Clogging Surface

Light and Ventilation

Make a comparative test with the grease you are now using

Out of fairness to yourself you should investigate the merits of Albany Grease. A 100% pure tallow lubricating compound, perfectly balanced for lubricating pulverizers, shafting, grinders, conveyors, mixers, etc. Never drips. Try a can.

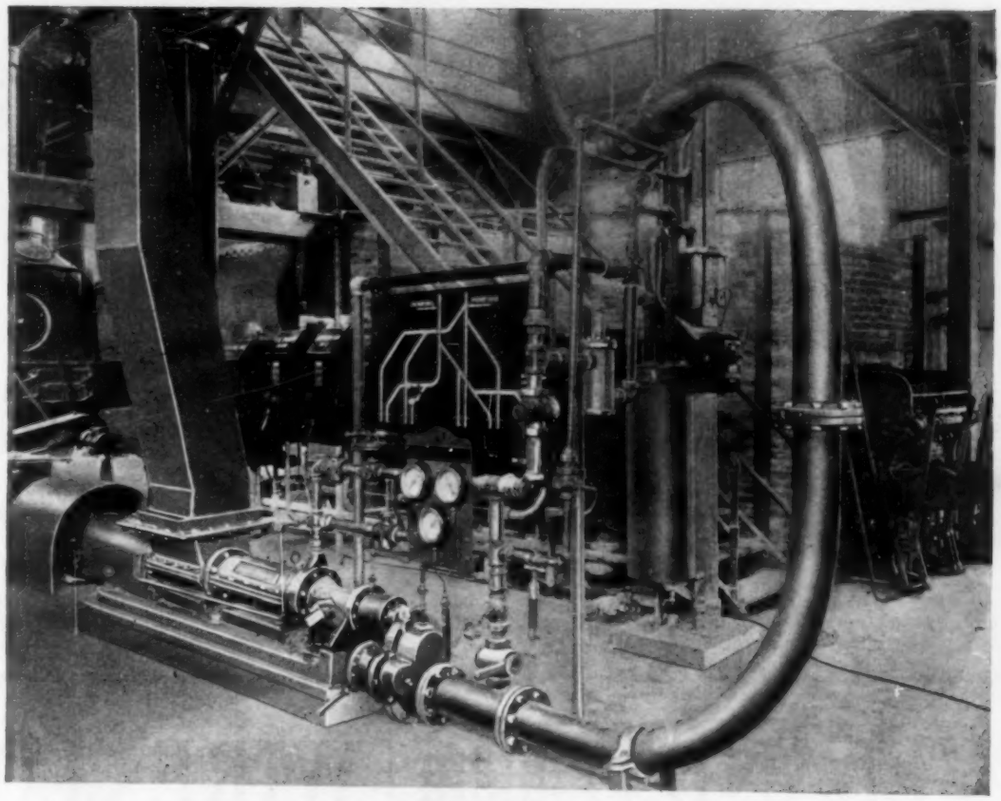
If you want an extra fine mineral oil lubricant, use Albany Pressure-grease — soft, medium, hard, also graphite and transmission.

Demand Albany Grease, refuse substitutes—look for the trade mark. If your dealer cannot supply you, write us.

ALBANY GREASE

Adam Cook's Sons, Inc. 6 Varick St., New York

High Capacity in Conveying— Quiet and Dustless in Operation



Fuller-Kinyon Pump handling raw gypsum at a large Eastern Gypsum Works. Two Fuller-Kinyon Systems, one of which handles hot calcined gypsum, are installed in this mill.

The FULLER-KINYON Conveying System

effects important economies in handling dry pulverized materials

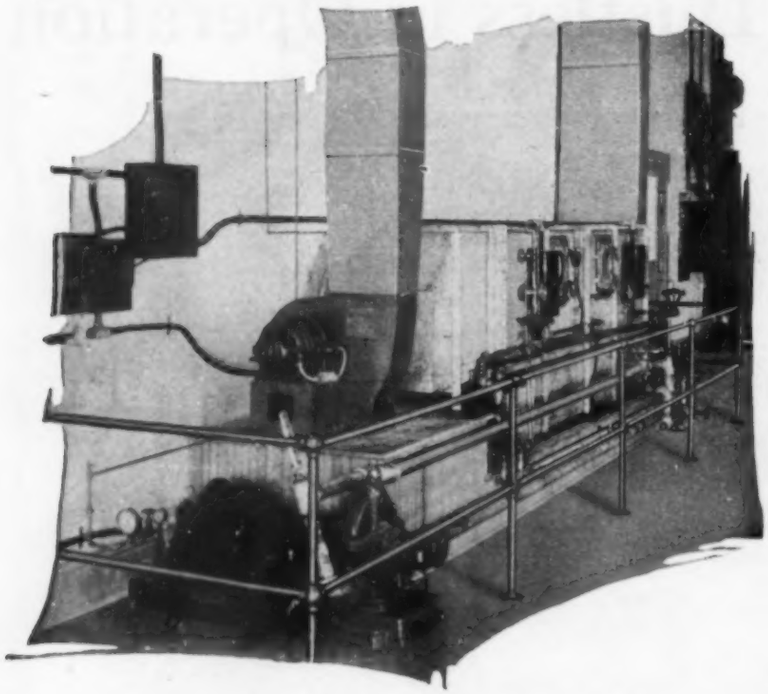
Greatly simplifies conveying, elevating and distributing the materials by pumping them in an aerated state through enclosed pipe lines. The pipes may be run horizontally, vertically or around bends to clear any obstruction. The maximum flexibility is provided.

Centralized control from a conveniently located panel permits the operator to open or close electrically operated distributing valves into bins in any desired order. When desired any sequence of filling or emptying of bins may be automatically performed. Push button cut-outs permit the operator to interrupt or change the normal sequence at will. The functioning of the Fuller-Kinyon is continuously reproduced in miniature or an illuminated panel board to guide the operator.

The Fuller-Kinyon Conveying System is successfully handling raw and finished cement, bauxite, manganese dioxide, graphite, pearl starch and 30 other materials. *Write us for full information concerning its application to your requirements.*

Fuller Company, Catasauqua, Penna.

Make Your Own Weather!



Typical Installation of Bayley Equipment for supplying washed, tempered, humified air.

Free yourself from loss by evaporation, excess humidity, dust explosion hazard, "sweating" of rooms and machinery,—weather troubles generally and difficulties due to "climate" in your plant.

With Bayley Air Conditioning Equipment you can control positively every day in the year, humidity, temperature and condition of the air, actually, make your own weather.

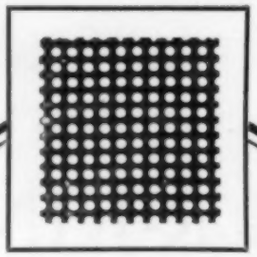
Write briefly, stating the nature of your difficulties.

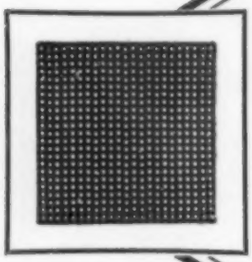
BAYLEY BLOWER COMPANY
772 Greenwich St. Milwaukee, Wis.

Bayley
AIR ENGINEERING & EQUIPMENT
HEATING AND VENTILATING
AIR WASHING AND HUMIDIFYING SYSTEMS
MILL EXHAUSTERS—PRESSURE BLOWERS
MECHANICAL DRAFT FANS
AIR AND GAS SCRUBBERS
INDUSTRIAL DRYING SYSTEMS

CLEVELAND WIRE CLOTH

A Cloth for Every Purpose

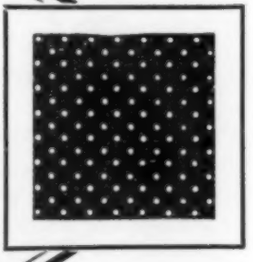


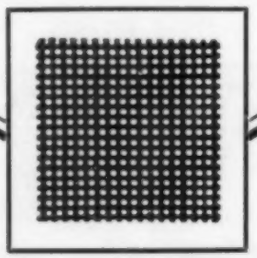


VARIOUS meshes to meet specific conditions, different metals to overcome chemical action, and designs that are backed by a knowledge of process application insures better results over longer periods of time from Cleveland Wire Cloth.

More than 14 years devoted to exclusive manufacture of wire cloth and a comparatively new, modern plant offers the utmost in service and engineering to users of this product.

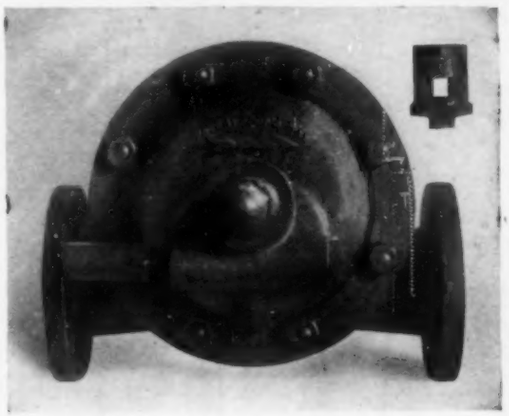
Prices and samples on request





The Cleveland Wire Cloth & Mfg. Co.

3574 E. 78th St.
Cleveland, Ohio



The SAMPLITT

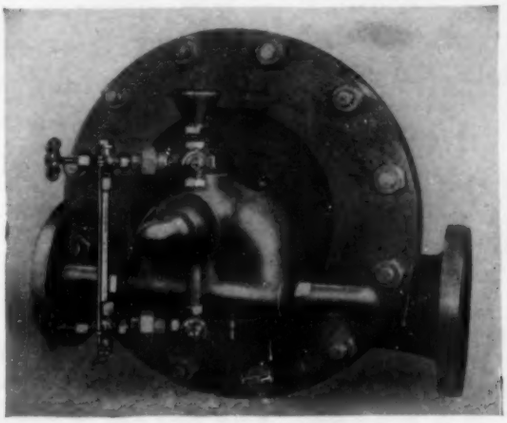
PERHAPS the most severe service which the SAMPLITT has been called upon to render has been for the sampling of tars. Here the machine produces a truly composite sample of heavy viscous material which is frequently loaded with a high percentage of suspended impurities.

The fact that it operates satisfactorily without interruption in this service tends to indicate that it can be depended upon under almost any conditions.

Booklet on request.

If you sample it at all
SAMPLITT right.

THE MIXITT



QUITE a number of MIXITTS have recently been installed in connection with the chemical treatment of boiler feed water. Frequently either too much or too little chemical will be responsible for the formation of scale.

The MIXITT automatically feeds to the water just the right amount of chemical required once it is adjusted to suit a particular condition irrespective of the rate of flow of the water to the boilers.

Booklet on request.

If you mix it at all
MIXITT right.

MAX B. MILLER & CO. Inc.
501 FIFTH AVENUE
NEW YORK

Chewing, too, is Dings protected

THE same protection against stray iron given the china people eat from, the paper they write on, the food that both people and live stock live on, the crushers and other machinery that help manufacture scores of products, is also given to your chewing. "Red Man" chewing tobacco and other well-known brands of the Pinkerton Tobacco Co., Toledo, are protected by Dings Magnetic Separation.

Check up on iron in your own plant, the nails, wire, bolts, etc., that inevitably come with raw materials. Dozens of industries, hundreds of plants, are finding real profit in Dings sure protection. Perhaps you, too, will find profit in protecting products and machinery against impurities and damage, in removing the danger of fire or explosion where iron goes through the process. Information or the help of experienced engineers on request.

More than 8,500 Dings Separators are in service!

Dings Magnetic Separator Co.
666 Smith Street, Milwaukee, Wis.
Established in 1899

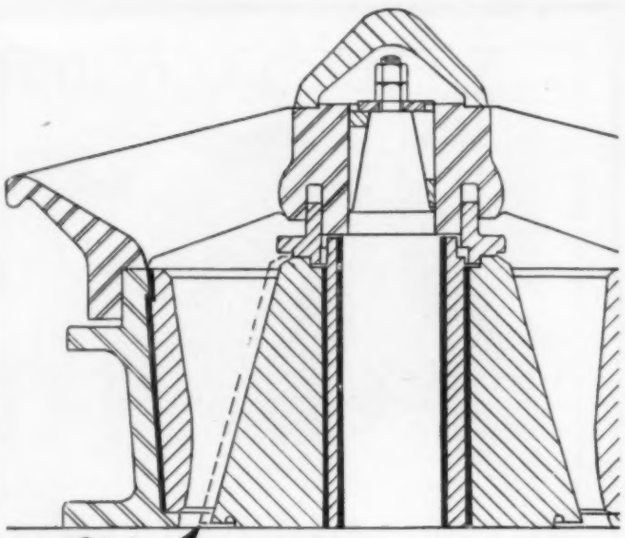
New York City
30 Church Street
Boston: 304 Rice Bldg.

San Francisco
419 Call Bldg.
Seattle: 2208 First Ave., S.

Branch Offices in Other Principal Cities

Dings High Intensity MAGNETIC SEPARATION

C&ME12Gray



This is the

TELSMITH Parallel Pinch!

Inside the cone, between the shaft and the crushing head, is Telsmith's long sleeve eccentric. It's nearly as long as the shaft. The shaft itself is rigidly fixed—in fact, it's famous for its ability to stay put. The eccentric acts directly on the head and gyrates the crushing head *horizontally*. The parallel throw of the eccentric produces Telsmith's long, straight pinch, as long at the very top of the head as at the bottom. The instant big chunks enter the bowl they get the full strength of the crushing stroke. One c-r-u-n-c-h is enough. Fast action — *without slippage* — that's Telsmith.

Write for Catalog 163 (Telsmith Primary Breaker) and Bulletin 2F17 (Telsmith Reduction Crusher).

Consult the nearest representative or write or wire TELSMITH direct.

SMITH ENGINEERING WORKS
1812 Holton Street, Milwaukee, Wis.

Canadian Representative:
Canadian Ingersoll-Rand Co., Montreal, P. Q.

11 West 42nd St., New York City
716 Builder's Bldg., Chicago, Ill.
Harrison Bldg., Philadelphia, Pa.
K. B. Noble Co., Hartford, Conn.
Beckwith Mchy. Co., Pittsburgh, Pa.
Brandeis M. & S. Co., Louisville, Ky.

TELSMITH

B. 4.

Hy-Speed Mixers

MIX ANY JOB BETTER

From heavy, viscous liquids to thin, watery fluids . . . from 1-gallon containers to 50,000-gallon vats . . . from active, delicate chemicals to perishable food ingredients. . . . ALSOP manufactures the mixer that will do the job more thoroughly, more quickly, and more economically than any other equipment or method.

Type No. 9

THE MASTER MIXER

The most powerful and efficient mixer for the toughest mixing jobs. From 2 H.P. up.

BACK-GEARED *2-Speed* MIXER

A simple, instantaneous two-speed adjustment adapts this unit to special process work on heavy, viscous liquids. Sizes from ½ to 1½ H.P.

PATENTED

The features that insure the supremacy of "*Hy-Speed*" Mixers are fully covered by U. S. Patents.

Type No. 8

DIRECT-DRIVE MIXER

. . . for large tanks of thin liquid, and continuous agitation.

UNIFORM, BETTER RESULTS!

. . . on any mixing job . . . are assured by the "*Hy-Speed*" mixer designed to solve similar problems in efficient mixing, usually after all other methods had been tried and failed. Our willingness to work with the manufacturer on difficult problems has resulted in our production of the *only complete line* of liquid-mixing equipment. Additional models not illustrated are available from one-twentieth H.P. up.

Write for our New Mixing Equipment Catalog

"*1,000-Speed*" MIXER

Automatic speed range from 10 to 3,000 R.P.M. A revolutionary mixer for exceptional work. Sizes ½ to 1½ H.P.

Alsop Engineering Co.

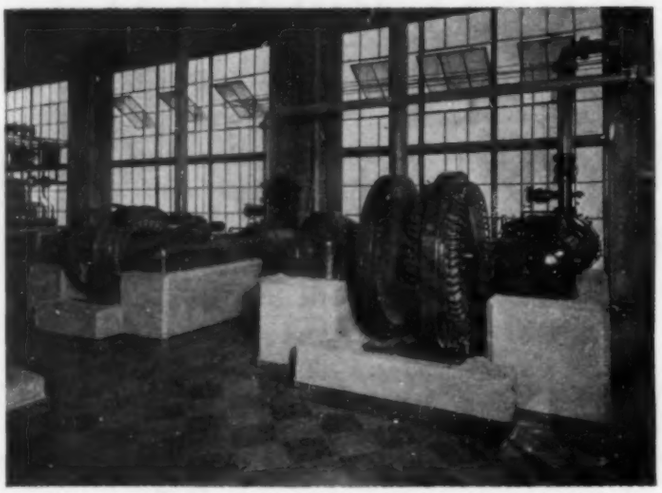
Electric Mixers, Filters, Pumps, Bottle-Fillers, Glass-Lined Storage and Mixing Tanks

47 WEST 63rd STREET **NEW YORK CITY**

Making a Cement Mill Dustless with NORBLO Dust-Collecting Equipment

THE PROBLEM

In building their great cement mill at Birmingham, Alabama, the executives of the Phoenix Portland Cement Co. were determined to have the best-equipped plant in the world, and to eliminate all dust — thus safeguarding employees' health, and enormously reducing the wear and maintenance cost of their machinery. To make the plant absolutely DUSTLESS appeared impossible, but—



Does this look like the raw grinding department? It does not. NORBLO made it COMPLETELY DUSTLESS

THE SOLUTION

Their engineers got together with NORBLO dust-collecting specialists. A plan for equipping the plant throughout with a NORBLO Dust-Collecting System was prepared, guaranteed and installed by NORBLO engineers. These results may be judged from this illustration of the raw grinding mill. Neat floor-covering — open type driving motors in the same room as the grinding mills — even switchgear and instruments needing no protection — the plant is COMPLETELY DUSTLESS.

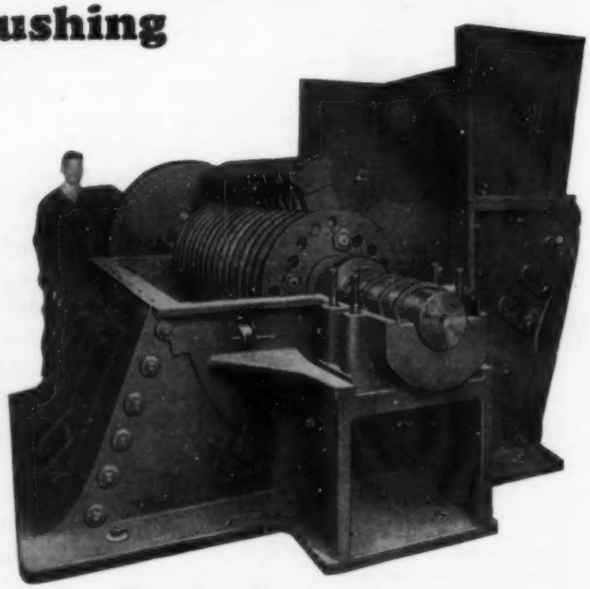
PUT YOUR DUST-PROBLEMS UP TO US—WE'LL SOLVE THEM

NORTHERN BLOWER CO. 6500 Denison Ave., Cleveland, Ohio.

"American Cyanamid" crushing 4 ft. cyanamid to 48 mesh in two operations

The three Williams Hammermills at the American Cyanamid Co., Niagara Falls, Ontario furnish an excellent idea of the way Williams is cutting first cost and operating expense in crushing, grinding and shredding operations.

Huge pieces of hard, tough cyanamid—anything which will pass through the 62 in. x 48 in. feed opening—are crushed by one Williams Mammoth crusher to 2 in. and smaller at the rate of 100 tons per hour. Directly following the Mammoth two No. 8 Williams Pulverizers reduce the cyanamid to 48 mesh. These machines doing in two operations the same work usually requiring three or four steps, 50% larger investment and increased crushing costs with any other type of equipment. Williams builds over 300 types of crushers, grinders and shredders for every material from glass to vegetable matter. Get our recommendations.



Williams Mammoth Crusher with cover removed to show crushing hammers

Williams Patent Crusher & Pulverizer Co.
2706 N. 9th St, St. Louis, Mo.

Chicago 37 W. Van Buren St. | New York 15 Park Row | San Francisco 415 Fifth St.

THE WILLIAMS PATENT CRUSHER & PULVERIZER CO. ST. LOUIS, MO. U.S.A. "TRADE MARK" REG. U.S. PAT. OFF.

Williams

ORIGINAL PATENTEES AND WORLD'S LARGEST BUILDERS OF HAMMERMILLS

PATENT CRUSHERS GRINDERS SHREDDERS

The Cloth on the Dorrco Filter Breathes . . .

. . . this means long life!

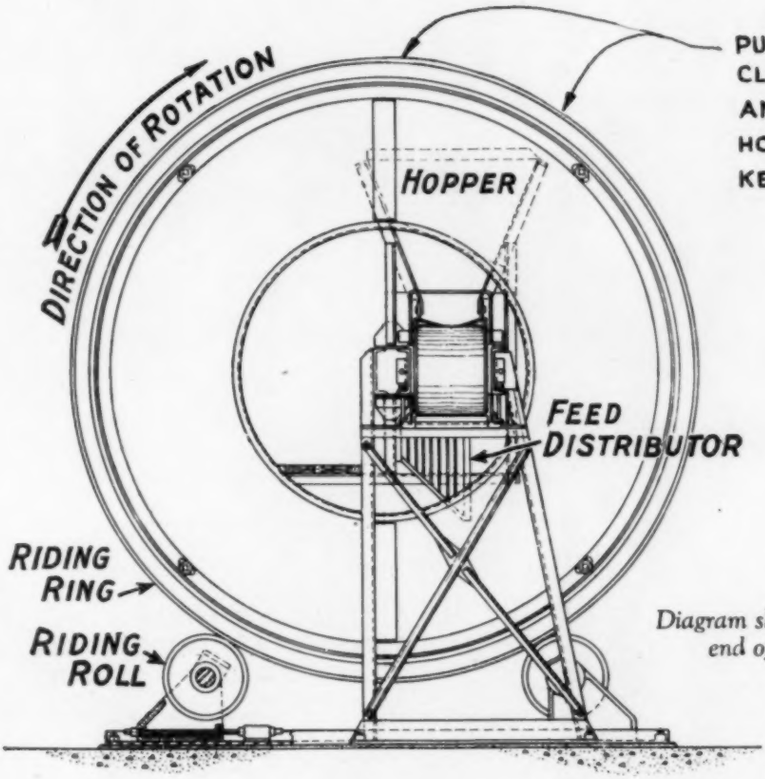

PULSATIONS ARE APPLIED TO CLOTH. THE CAKE IS LOOSENED AND FALLS INTO DISCHARGE HOPPER. BREATHING ACTION KEEPS CLOTH PORES OPEN.
DIRECTION OF ROTATION
HOPPER
FEED DISTRIBUTOR
RIDING RING
RIDING ROLL

Diagram showing cake discharge end of a Dorrco Filter

PLUGGED up cloths with resultant decreased capacity, excessive wear on cloths, frequent acid treatments, these and other troubles follow when fines are gradually rubbed into the pores of a filter cloth.

In the Dorrco Filter there is no such rubbing action. Once in each revolution, as the cake discharges, pulsations are applied to the cloth. The cake is loosened and falls freely into the discharge hopper; the gentle breathing action keeps the pores open and the cloth in good condition for long periods. The 'breathing' of the cloth not only reduces troubles with plugged cloths, but length of cloth life is materially increased.

This feature of the Dorrco has been found particularly beneficial where acid treating is required. At one plant a Dorrco Filter installation increased length of run between acid treats by 300%, as compared with previous practice.

Our nearest office will send you Bulletin 8081, which describes the construction and operation of Dorrco Filters. Write for a copy.

DORRCO

THE DORR COMPANY

ENGINEERS

247 PARK AVENUE NEW YORK CITY

INVESTIGATION TESTS DESIGN EQUIPMENT

DENVER, COLO.
1009 17TH STREET

CHICAGO, ILL.
310 SOUTH MICHIGAN AVENUE

LOS ANGELES, CAL.
108 WEST 6TH STREET

WILKES-BARRE, PA.
936 MINERS BANK BUILDING

JOPLIN, MO.
319 JOPLIN NATIONAL BANK BUILDING

ATLANTA, GA.
1803 CANDLER BUILDING

TORONTO, ONT.
330 BAY ST.

LONDON
THE DORR COMPANY, LTD.
16 SOUTH STREET, E. C. 2

BERLIN
DORR GESELLSCHAFT M. B. H.
KIELGANSTR. 1, W. 62

PARIS
SOCIETE DORR ET CIE
24 RUE DE LA PEPINIERE.

JOHANNESBURG, S. A.
E. L. BATEMAN
THE LOCARNO HOUSE.

MELBOURNE, AUSTRALIA
CROSSLE, SCOTT & DUFF PTY., LTD., 360 COLLINS STREET

The Bethlehem Pulverizer

Grinds a wide range of materials, to any degree of fineness up to 325 mesh.

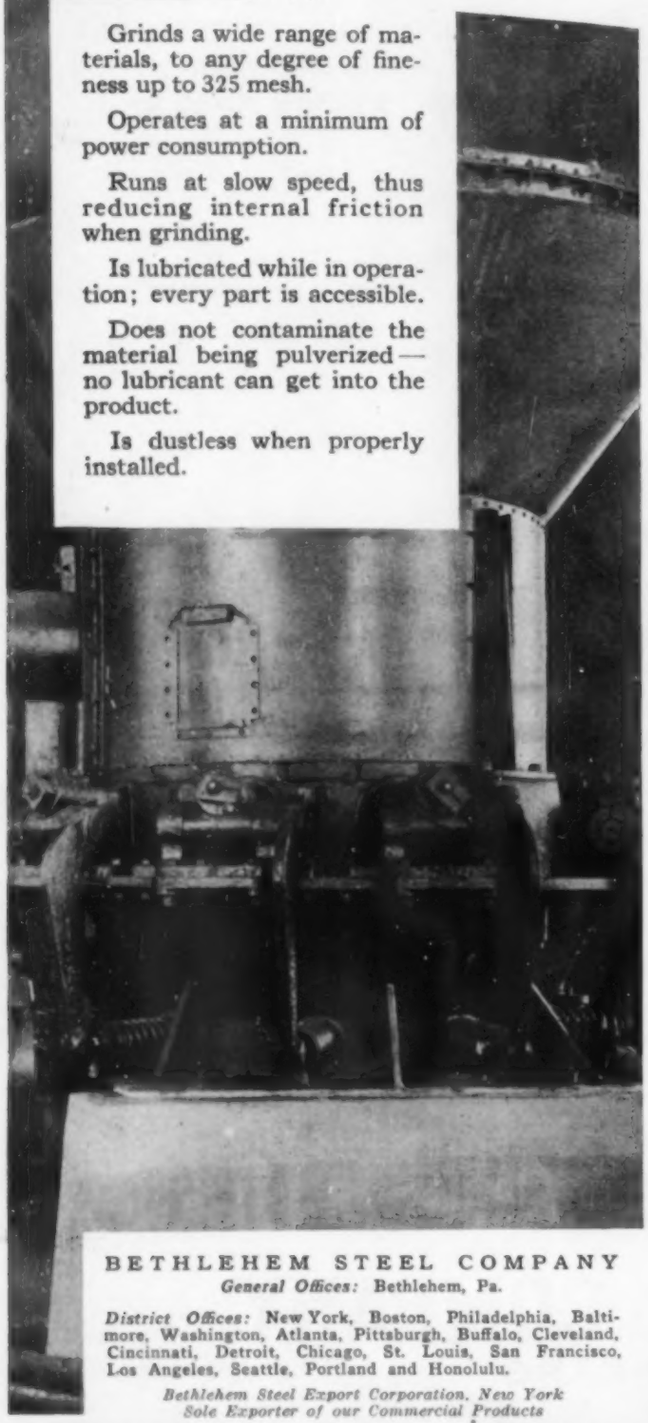
Operates at a minimum of power consumption.

Runs at slow speed, thus reducing internal friction when grinding.

Is lubricated while in operation; every part is accessible.

Does not contaminate the material being pulverized — no lubricant can get into the product.

Is dustless when properly installed.

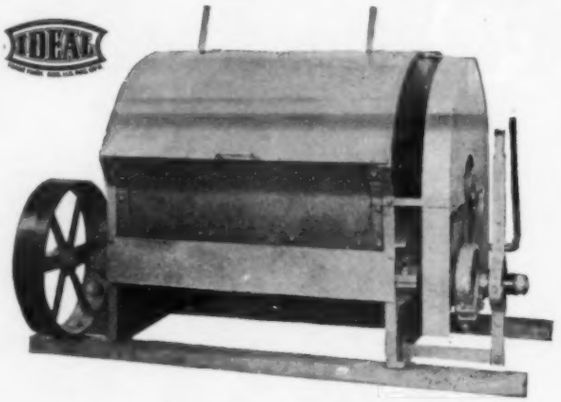


BETHLEHEM STEEL COMPANY
General Offices: Bethlehem, Pa.

District Offices: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Pittsburgh, Buffalo, Cleveland, Cincinnati, Detroit, Chicago, St. Louis, San Francisco, Los Angeles, Seattle, Portland and Honolulu.

Bethlehem Steel Export Corporation, New York
Sole Exporter of our Commercial Products

BETHLEHEM
PULVERIZER



It Handles All Kinds of Mixtures

The new Ideal Batch Mixer will mix *anything* that needs mixing—wet, dry, dusty, sticky, pasty or abrasive—*and mix it quickly and well.*

It's built in 9, 14, 21 and 42 cu. ft. capacities—by an organization that for 30 years has made a special study of mixing equipment.

Built for hard work and long life this unusually fine mixer is described and illustrated in detail in a folder that will be sent promptly on request.

IDEAL INDUSTRIAL MACHINERY
Division of Consolidated C. M. Corp.
Winton Place, CINCINNATI, OHIO

WESTON CENTRIFUGALS

Original (1866)
Reliable
Economical

For All
Chemicals Requiring
Centrifugal Process

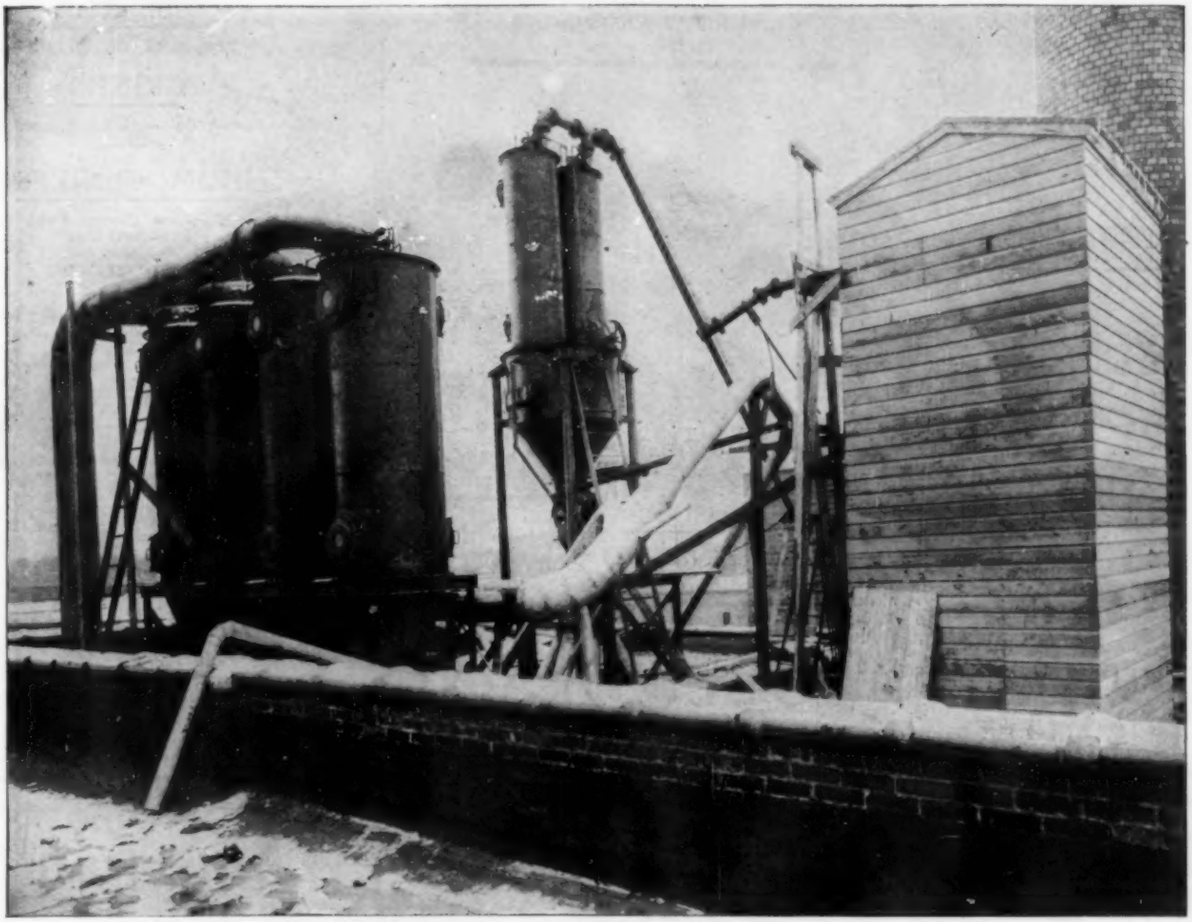
Automatic Sprayers for Washing Contents

Sizes 20-inch to 40-inch.

Materials of construction adapted to product

Established 1843
AMERICAN TOOL & MACHINE COMPANY
Trade Mark Registered U. S. Patent Office
BOSTON

Dustless blending of lead oxides



DRACCO does it – –

An operation, which for years has been considered impossible, has been developed by Dracco and lead oxides are now blended without dust or health hazard in manufacturing battery paste.

Progressive manufacturers have come to realize that manufacturing can be carried on free from dust and explosion risk (where materials are of explosive nature), with less damage to mechanical equipment, labor cost lowered, material saved and a health hazard eliminated.

The installation shown handles from 5 to 6 tons of lead oxide an hour, one man, instead of four previously employed, runs the entire system, no loss of material in handling (50 to 75 pounds of material recovered per day, formerly lost) and not a case of lead poisoning developed since Dracco system was installed.

We can direct you to a host of Dracco installations where equally profitable results have been accomplished with this modern system. Write us for bulletins or let us send a representative if need is acute.

The Dust Recovering & Conveying Co.

Engineers and Manufacturers

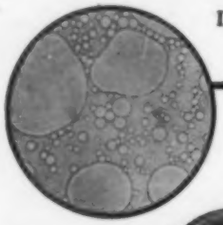
CLEVELAND, OHIO

DRACCO DOES IT

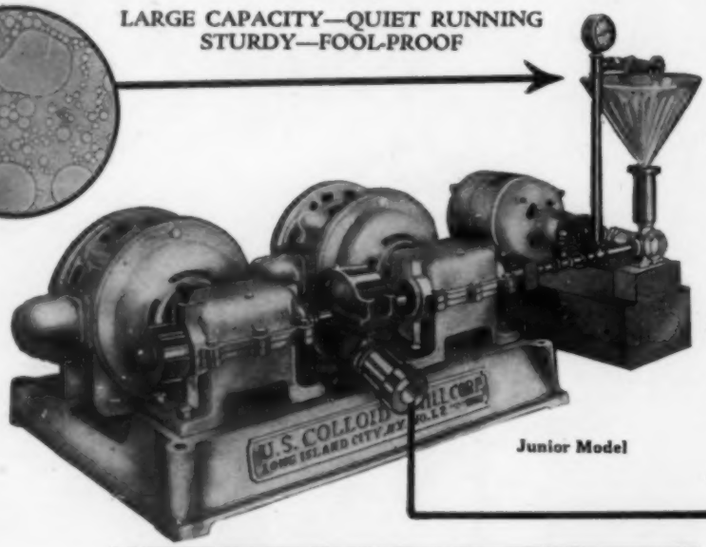
THE LATEST DEVELOPMENT IN COLLOID MILLS

LARGE CAPACITY—QUIET RUNNING
STURDY—FOOL-PROOF

From



Microphotograph of Material Before Colloidal Treatment.



Junior Model

DISPERSES
Pigments, Gums, Etc.

GRINDS
Paints, Colors, Inks, Pigments, Etc.

HOMOGENIZES
Milk, Ice Cream, Food Products, Etc.

EMULSIFIES
Oil, Etc., in Aqueous Solutions

To

Microphotograph of Material After Colloidal Treatment.

Industries using U. S. Colloid Mill

Pharmaceuticals
Printing Inks
Paints
Emulsions
Milk
Ice Cream

And Many Others

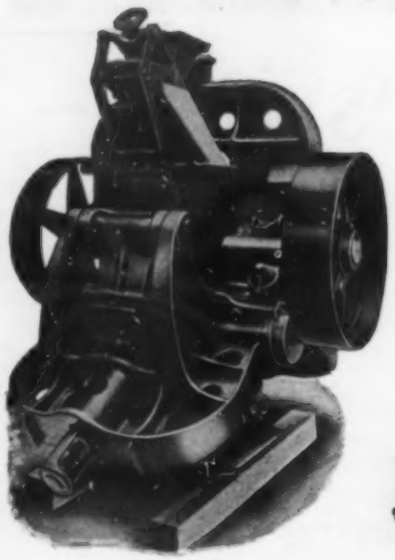
DOUBLE ROTORS REVOLVING IN OPPOSITE DIRECTIONS
CAPACITIES FROM 50 TO 1000 GAL. PER HOUR
LOW POWER CONSUMPTION—EASILY CLEANED

Descriptive Booklet sent on request

U. S. COLLOID MILL CORP.

13th to 14th Sts., East Avenue Long Island City, N. Y.

Maxecon Mill

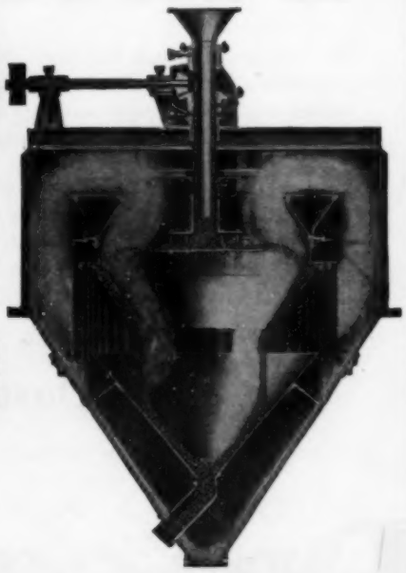


for economical pulverizing

Perfectecon Screen

for coarse screening

American Filter Air Separator



for fine separating

KENT MILL COMPANY

10 Rapelye Street Brooklyn, N.Y.

14 mineral fillers made from CELITE

A type to meet virtually any filler requirement

BARRIERS
TO INDUSTRIAL WASTE

FILTER-CEL
AND
SUPER-CEL
FOR FILTRATION

SIL-O-CEL
FOR HEAT INSULATION

CELITE
FOR BETTER CONCRETE

14 mineral fillers *made from* CELITE

8 to 33 pounds per cubic foot

The light weight of Celite fillers arises from their porosity and microscopic cellular structure. They are highly absorptive both of gases and fluids.

Practically pure Silica

Where resistance to acids is important Celite fillers are especially desirable because of their high silica content. Certain grades contain as much as 94 per cent SiO_2.

Fine particle size

Celite fillers are available in special grades so fine they will entirely pass through a 325-mesh screen. They are widely used in delicate polishes for gold and silver, as well as in coarser cleaning preparations.

Color

Certain grades of Celite fillers are snow white, others are grayish white or deep pink.

Tremendous surface area

Experiments have demonstrated that the surface area of the filler used often has a more pronounced effect on the properties of a product than any other single factor. Celite fillers have brought surprising improvements in a wide variety of applications.

Celite Service is always at your command to help you save money on your mineral filler requirements

L-577

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Eliminates danger of choke-up from excessive feed—affords complete open door accessibility—6 other new production aids.

Eight features incorporated into the Sturtevant Ring Roll Mill are bringing about valuable improvements in the pulverizing of such diverse materials as limestone, cement, marble, firebrick, shells, phosphate rock, iron borings, manganese, etc.

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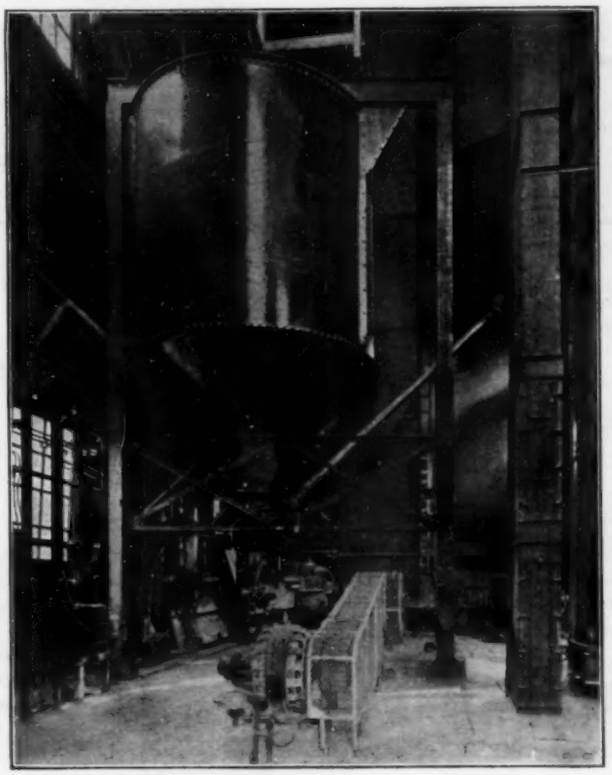

Sturtevant Ring Roll Mill in Closed Circuit with Air Separator

Simplicity of Operation

The operation of the Sturtevant Ring Roll Mill is as simple as it is superior. For example: There is a large ring revolving at low speed. Material 1½ in. and finer is fed in a large stream in direction of rotation from a spout in the center of the ring. Material is held in place by centrifugal force generated by rotation. Material then builds up to a predetermined depth (½ in. to 1½ in.). Three rolls fitted within the ring expand outwardly against the revolving material. Rolls start revolving immediately upon contact with the material. Pressure is regulated by large adjustment springs. The material embedded upon the ring is crushed as it passes under the rolls. Thus, material crushes upon itself eliminating wear on ring and rolls. There are no pushers to revolve the rolls. No plows to force material on ring or under rolls. No scrapers to assist discharge. No shields to keep material on the ring. Nothing to wear save the ring and rolls. But as the ring is coated with material from ½ in. to 1½ in. deep, the ring NEVER touches the rolls. Wear and tear is thus transferred to the material being ground. This takes the sting out of repair bills.

8 Practical Advantages

The use of the Sturtevant Ring Roll Mill affords you these 8 practical advantages:

1. Complete open-door accessibility—easy opening, safe-like door brings all wearing parts into the open. Easily inspected and repaired.
2. No separating devices or screens within the mill to hamper free action. Eliminates danger of choke-up under excessive feed.
3. Cannot be overfed or clogged. If excessive feed is given material passes off freely and untouched.
4. Gives uniform grinding because concave ring and convex rolls give parallel surface. Pressure is equal over width of rolls.
5. Single purpose machine—for pulverizing only. This eliminates wearing parts and reduces power charges, thus reducing production costs.
6. Practically noiseless and vibrationless thus permitting use of inexpensive foundations.
7. Roller bearings running at low speed, minimization of friction and free discharge make for low power costs.
8. Has output range from 8 to 200 mesh.

Thus does the Sturtevant Ring Roll Mill meet selective machine requirements—low initial cost, reliability, ease of operation, freedom from repairs, foundation cost, low power and economy of space. And these are the requirements which determine commercial efficiency when reduced to dollars and cents per ton of product.

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To determine accurately what the Sturtevant Ring Roll Mill will do on your material; to show how much you can cut grinding costs and difficulties accept our Laboratory Test Report as follows:

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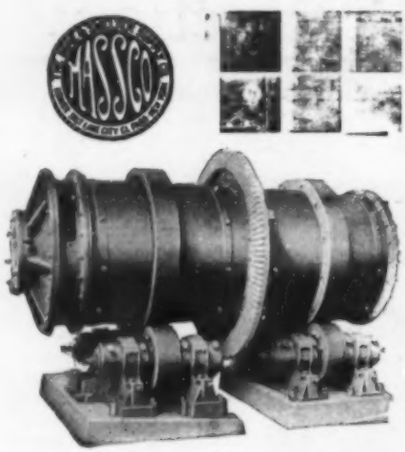

Marcy Rod Mill of the type used on sand-lime brick production.

CONTINUOUS grinding offers so many advantages over batch grinding that it should be adopted wherever possible.

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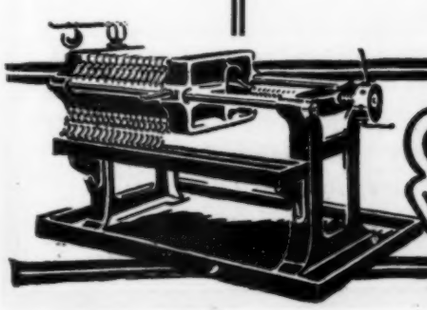

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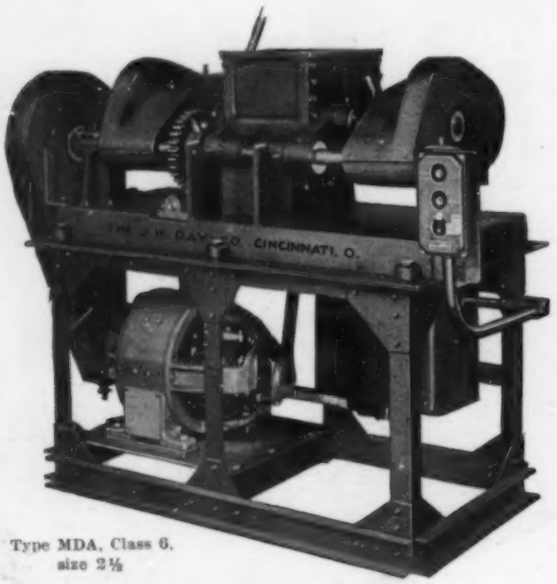

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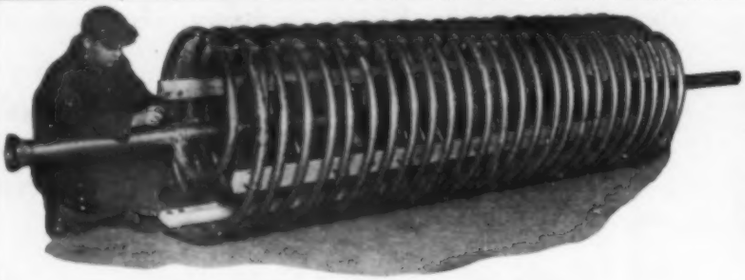

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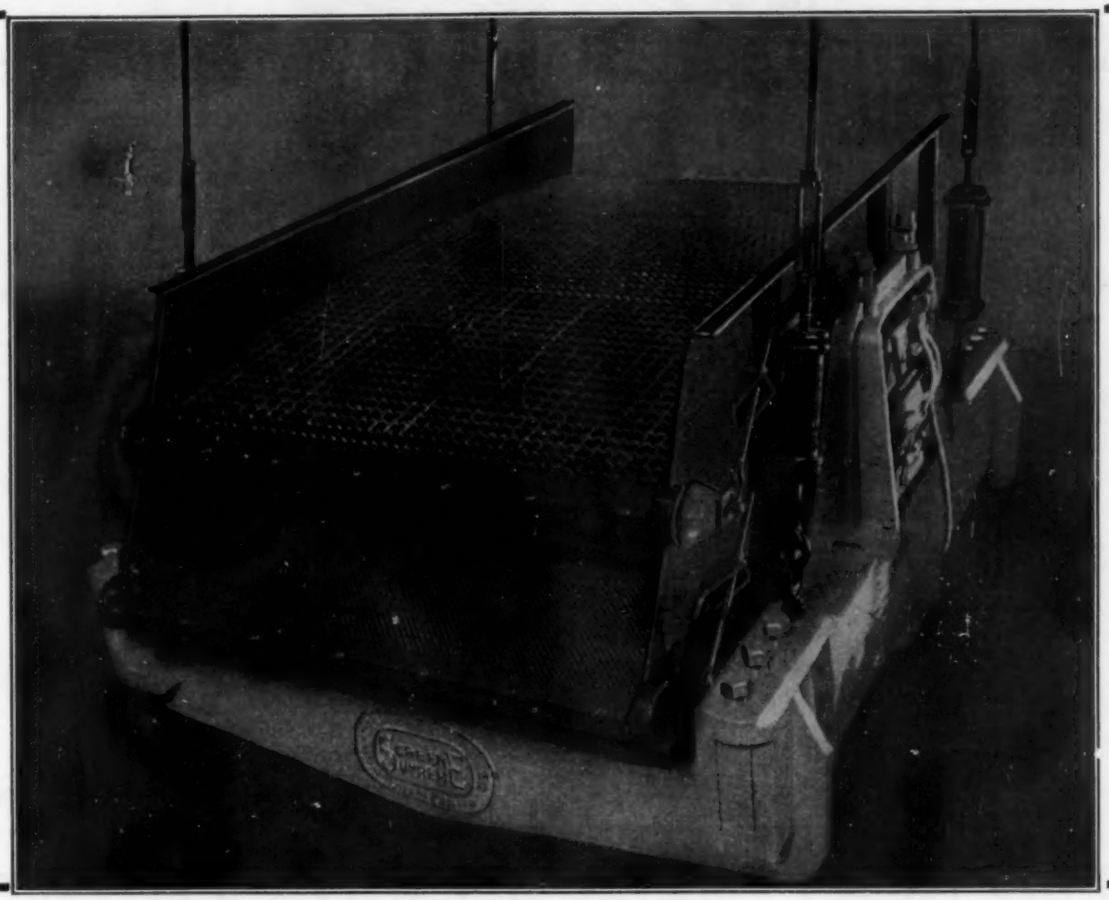

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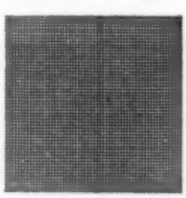

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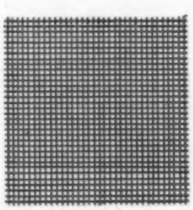

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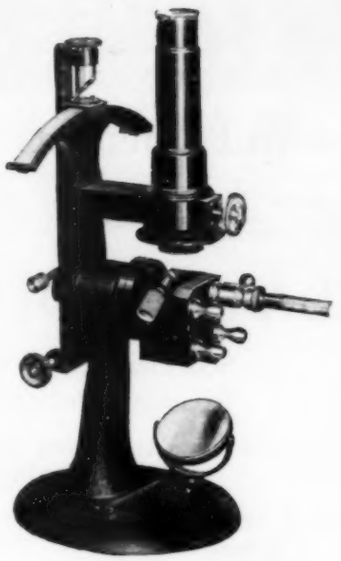

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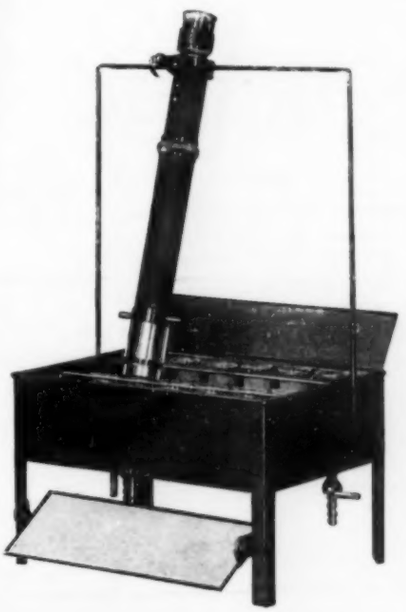

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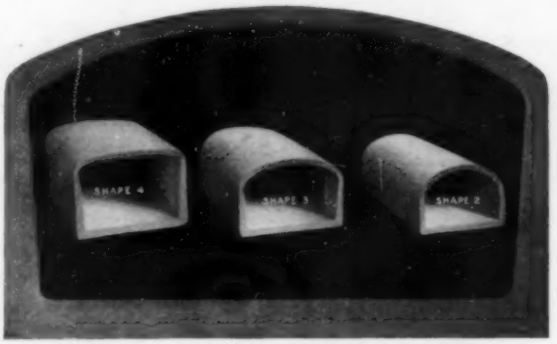

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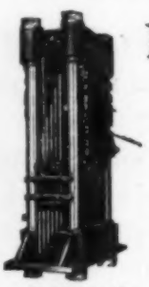

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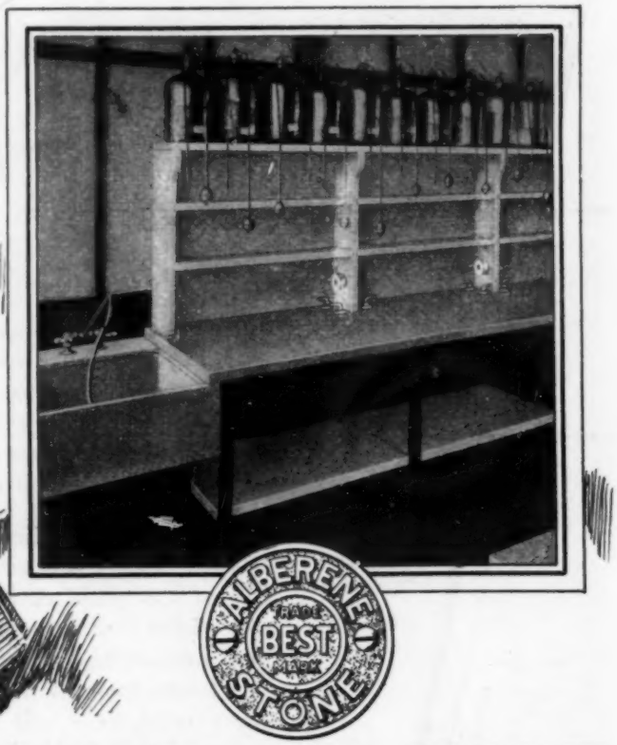

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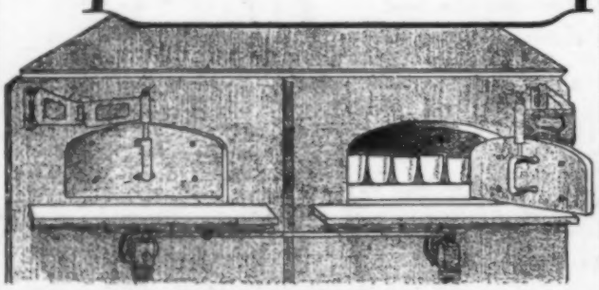

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XII.—Finished-stock Costs
XIII.—Entering Costs on the General Books
XIV.—Making up Statements
XV.—Using Cost Variations to Control Costs
XVI.—Tabulating Cost Data
XVII.—Fixed-property Analysis
XVIII.—Fixed-property Accounting

242 pages
6x9
illustrated
$3.00

For the manufacturer—the engineer—the accountant—successful methods, proved procedure, sound data on accounting and cost finding for the chemical industries.

Order a copy Now

McGRAW-HILL
FREE STAMPING OFFER COUPON

McGraw-Hill Book Co., Inc., 370 Seventh Avenue, New York.

Send me **Prochazka's Accounting and Cost Finding for the Chemical Industries**, with name stamped in gold on front cover. I enclose proper remittance and understand that stamped copies are not returnable. (This offer expires Jan. 1st, 1929.)

.....
(Name to be stamped)

Signed .....

Address .....

Official Position .....

Name of Company .....

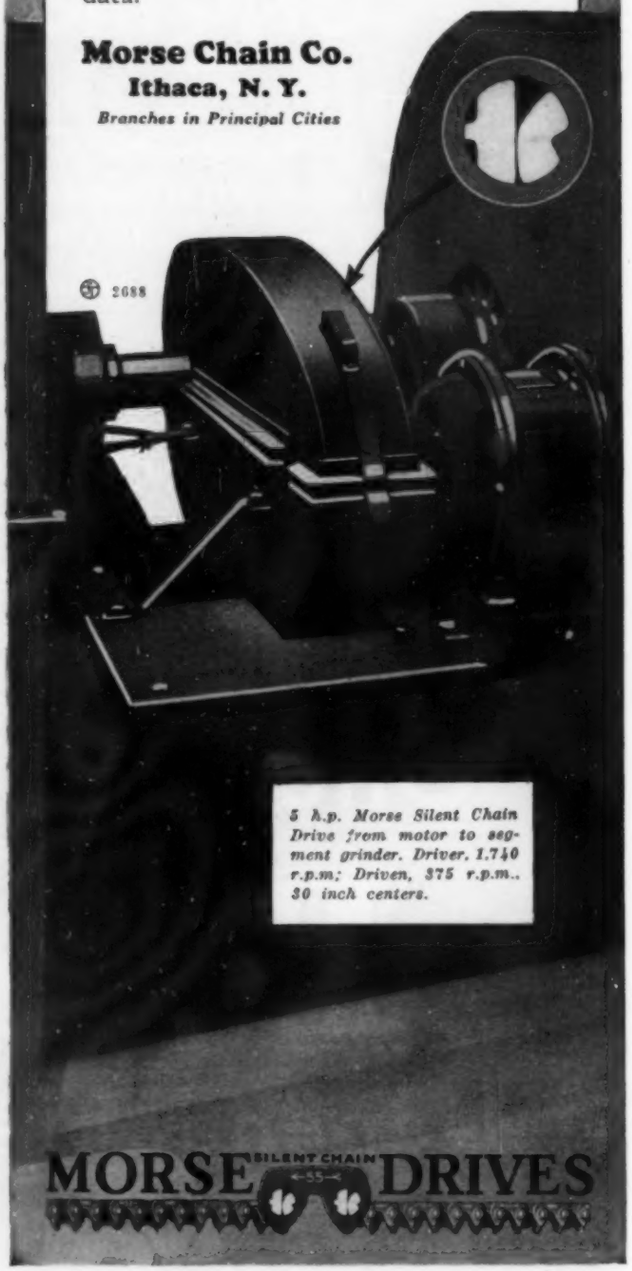
M. 12-1-28

Driving grinders

Segment grinders are used at this plant for removing the rough spots from porcelain ware. Each grinder is supplied with dependable power through a motor and Morse Silent Chain Drive. This permits convenient mounting of the motor close to the machine, thereby saving valuable space.

Morse Drives are 98.6% efficient, positive, flexible, ideal for short centers. One tenth or 5,000 H.P., the same dependable results are possible. Ask a Morse Transmission Engineer for complete data.

Morse Chain Co.
Ithaca, N. Y.
Branches in Principal Cities



5 h.p. Morse Silent Chain Drive from motor to segment grinder. Driver, 1,740 r.p.m.; Driven, 375 r.p.m., 30 inch centers.

MORSE SILENT CHAIN DRIVES

"Ignorance is the cause of economic waste"

—said Mr. O. H. Cheney, Vice-President of the American Exchange-Pacific National Bank, New York City, in a recent address. "Ignorance of the facts of supply and demand is the cause of troubles which affiict the separate industries. Ignorance of efficient business methods is the cause of individual failure."

There is no need, today, for the individual business man to be in the dark about conditions and improved practice in his field. The business press particularly those publications belonging to the A.B.P., are serving industry better and more completely than ever before.

Fight waste with facts from A. B. P. papers

Get the most out of your business paper. Read its editorials for the worth-while opinions of men who know. Read its technical articles to keep pace with current developments. Read its advertisements for dollar-saving suggestions.

You fight waste with facts when you get your information from an A.B.P. publication—this one, for example. High standards of accuracy in editorial as well as advertising content are exacted as a condition of membership in the Associated Business Papers, Inc.

Advertisers in A.B.P. papers are combating selling waste by reaching selected groups of readers who are searching for just such economical suggestions as the advertisers have to offer.

Are you making the most of this, your business paper?

Be a consistent reader of your paper. Each issue contains information that you would not want to miss.

THE ASSOCIATED BUSINESS PAPERS, Inc.
Executive Offices: 52 Vanderbilt Ave., New York, N. Y.

A.B.P.

An Association of none but qualified publications reaching 54 fields of trade and industry.

Radial Brick Chimneys
for INDUSTRIES using
CHEMICAL PROCESSES

Acid Proof Chimneys
Handling
ACID GASES

For Smelters, Chemical Works, Paint Works, By-Product Coke Ovens. ALSO for BOILERS, Ovens and Furnaces. All Sizes.

Built of Impervious Radial Brick

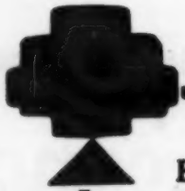
Also Builders of

Reinforced
Concrete Chimneys

Send for Free Booklet CM7 "Construction and Design of Chimneys Subjected to Acid Gases."

ALPHONS CUSTODIS CHIMNEY CONS. CO.
95 Nassau St., New York Marquette Bldg., Chicago

MONARCH



of
Brass—Iron—Steel
Rubber—Stoneware,
Etc.
for
Any Acid or Gas

Write For
Catalog 6-C

Monarch Mfg. Works, Inc.
2730 E. West Moreland St.
PHILADELPHIA, PA.

SPRAYS

Burlap or Cotton
New or Second-hand
Printed or Unprinted

Bags for

CHEMICALS
FERTILIZER
. . . etc . . .

I. T. RHEA, Pres.
Mente & Co.
Incorporated
New Orleans New York
Savannah Boston

Money out of Waste!

COTTRELL PROCESS of Electrical Precipitation

Calder-Fox Scrubbers

Reineke Regulators

The Cottrell Process not only raises the efficiency of operation by removing dust and "fume" from the smoke and air of your plant, but also salvages particles of value.

Operation is simple, and the installation of equipment soon pays for itself.

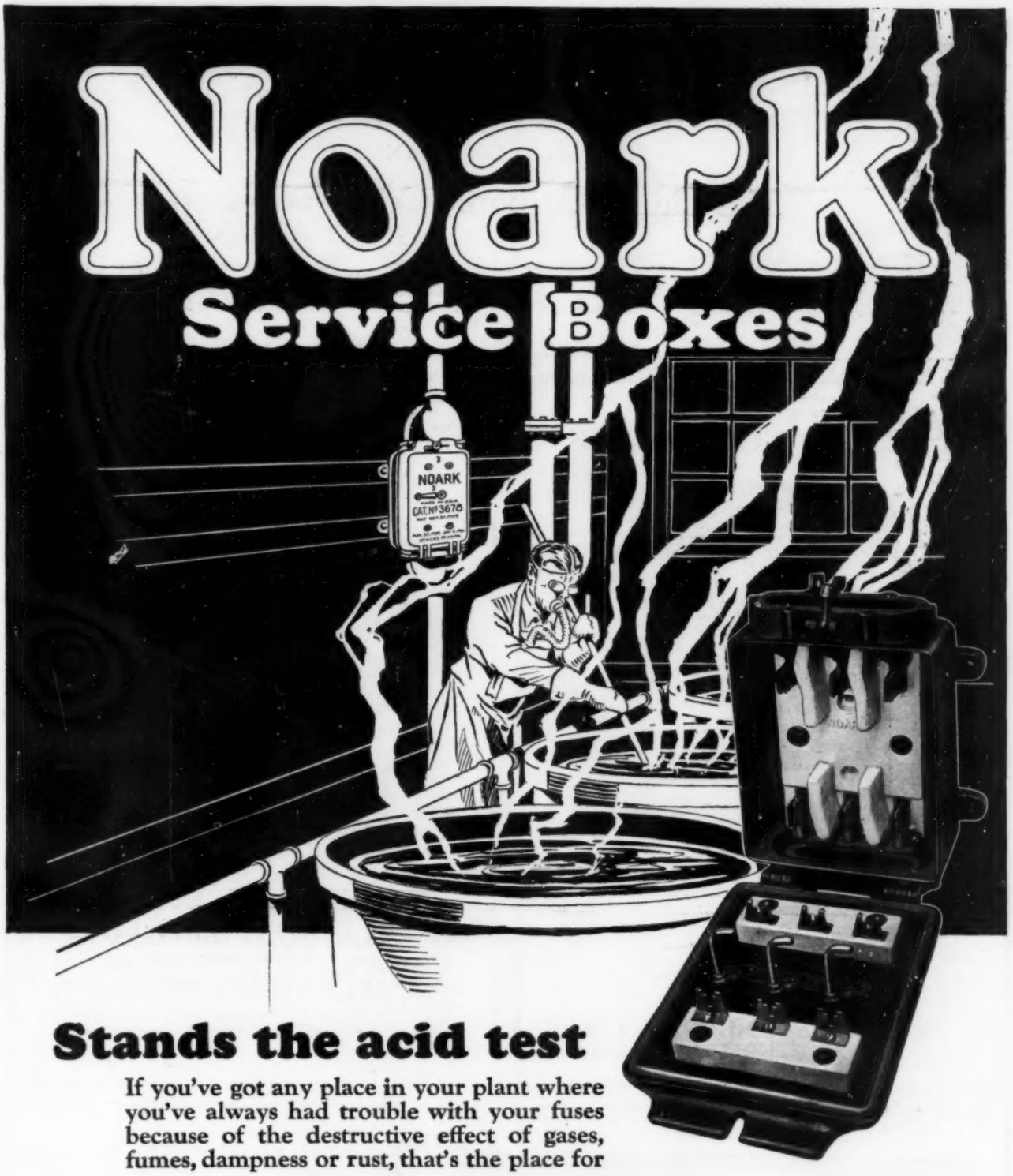
For Cement Mills the new type of Graded Resistance Electrode construction offers the advantages of the Process at still lower cost.

Calder Fox Scrubbers are the most modern device for sulphuric acid mist collection. Reineke Regulators are standard for the quick, accurate regulation of gas flow.

Western PRECIPITATION CO.
Los Angeles, California, 1016 W. 9th Street
Eastern Office: 25 W. 43rd St., New York City

Noark

Service Boxes



Stands the acid test

If you've got any place in your plant where you've always had trouble with your fuses because of the destructive effect of gases, fumes, dampness or rust, that's the place for

Noark Service Boxes

These are the boxes which stand up for years under conditions which destroy ordinary protective devices in a few weeks.

In 2, 3 and 4 pole types. 250 and 600 volt capacities.

Catalog No. 56 on request.

COLT'S PATENT FIRE ARMS MFG. CO.
ELECTRICAL DIVISION
HARTFORD, CONNECTICUT, U. S. A.
NEW YORK · BOSTON · PHILADELPHIA · PITTSBURGH · CHICAGO · SAN FRANCISCO 33-W-36

The Best Inert Gas—CO_2—All Uses

Quick Service from 31 Plants and Distributing Points

20 LB. AND 50 LB. CYLINDERS

The Liquid Carbonic Corporation

Wire or write nearest branch

Chicago	Atlanta	Cincinnati	Havana	Milwaukee	Pittsburgh
New York	Buffalo	Dallas	Kansas City	Minneapolis	Portland
Boston	Cleveland	Detroit	Los Angeles	Philadelphia	St. Louis
			Memphis		

Acid-Proof Pots

Fig. 88

All sizes, shapes and designs—with or without outlets, ground-in Faucets and Covers.

Acid, alkali and corrosion proof throughout the stoneware body.

Write for prices.

THE U. S. STONEWARE CO.

Works: (Since 1865) Akron, Ohio

Ask Albright—He Knows!

With 63 years' experience to back them, Albright Specialists know the type, design and material of coils and bends best fitted to give you maximum service—no matter what the conditions to be met.

Get the facts about Albright Co-operation Service in design selection and installation.

ALBRIGHT SON & CO.
COIL AND PIPE BENDERS
ALLENTOWN, PENNA.

TELEPOISE

A CONVEYOR SCALE

INDICATES, REGISTERS, RECORDS

THE Telepoise commands your confidence. It indicates, registers and records the true weight of the material conveyed.

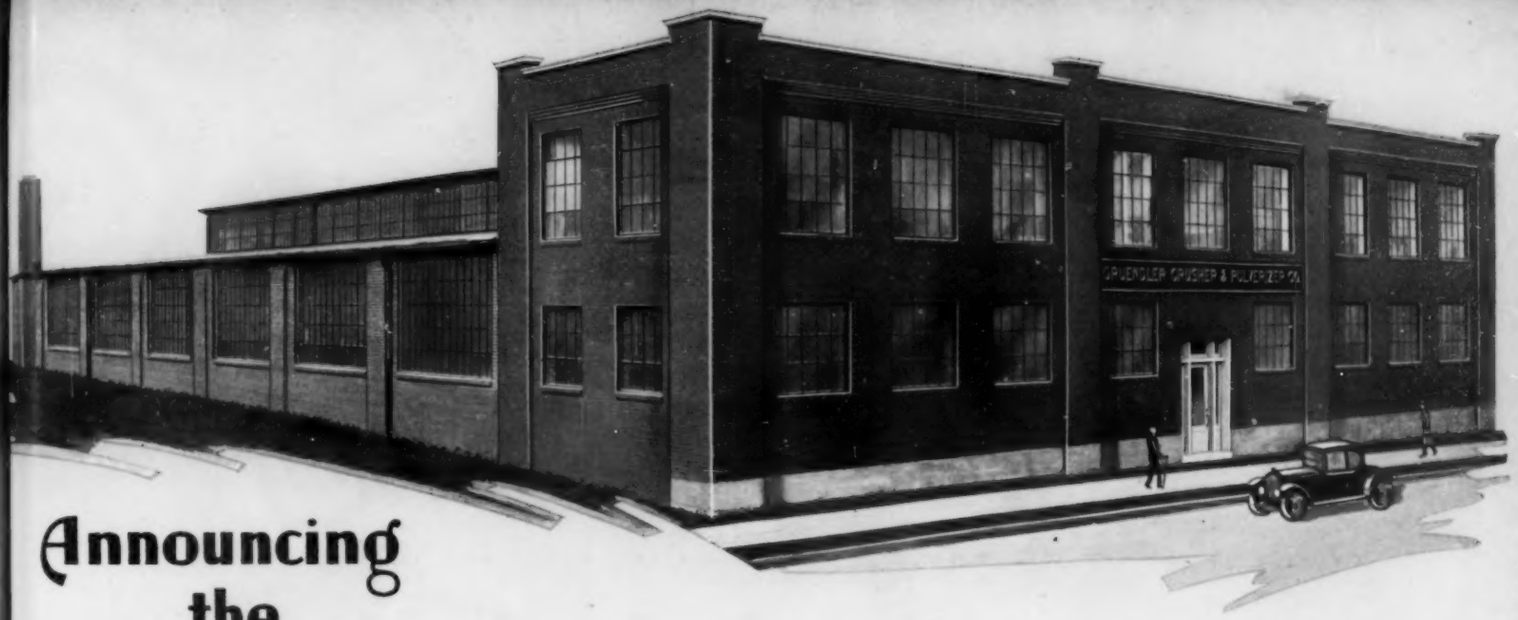
The Telepoise is developed to the same degree of reliability as the platform scale.

Simple—Dependable—Costs less

Write for Information

E. J. WHITE
Sales Agent
85 Cliff St.,
New York, N. Y.

JOHN CHATILLON & SONS
Scale Makers Since 1835



Announcing the New Plant

GRUENDLER

THIS month we inaugurate our New Plant at 29th and North Market Streets—the new home of Gruendler Crushers and Pulverizers!

Modern in every respect, the New Plant is the response to a nation-wide demand for Gruendler equipment—a demand that has made necessary the increased facilities and increased production now possible.

There is a significance to this new and greater building that goes beyond the structure, itself. It is a spirit which, though intangible, is of prime importance.

For the New Gruendler Plant—like Gruendler Crushers and Pulverizers—is the result of 44 years' experience in the manufacture of dependable equipment for crushing, grinding and mixing. It is a fitting monument to Gruendler Efficiency—and Gruendler Quality!

No Postage Stamp Necessary If Mailed Before Nov. 30, 1929

Postage Will Be Paid By Addressee

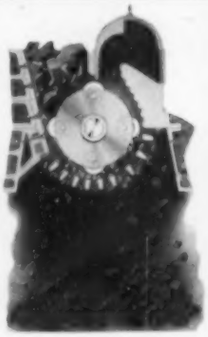
BUSINESS REPLY CARD
FIRST CLASS PERMIT NO. 342, SEC. 384½, P. L. & R., ST. LOUIS, MO.

Gruendler Patent Crusher and Pulverizer Co.
29th and North Market Streets
St. Louis, Mo., U. S. A.

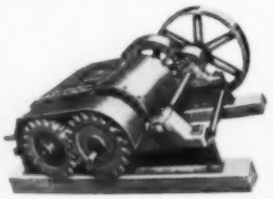
ANNOUNCING NEW FEATURES IN GRUENDLER EQUIPMENT

Time and test have won for Gruendler Crushers the title: *America's Leading Hammermills.* For, through almost a half-century, they have stood the test of actual performance under all conditions, as is evidenced by thousands of successful Gruendler installations. Scientifically correct in design, sturdy and dependable in construction—Gruendler Crushers give maximum production at minimum operating cost. Their ability to do just that makes Gruendler Hammermills the ideal crushers for *your* plant. Get the facts on the new Gruendler products and improvements for your field. Without any obligation, clip, check and return the attached post-card now.

Swing hammer crusher and pulverizer for rock, coal, cement, clay, etc.



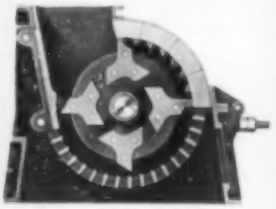
Centrifugal ring crusher for coal, iron ore, steel turnings.



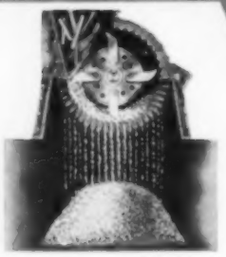
Double roll crushers for double belt or gear driven. For granulating and for the crushing of coal or stone into a fine, uniform product.

Portable jaw crushers for road-making—the most modern maintenance unit.

AMERICA'S LEADING HAMMERMILLS

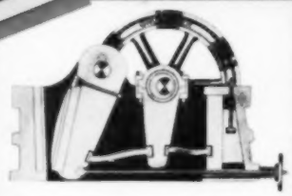


Rigid hammer shredder and crusher for bones and carcasses in rendering plants; also coal cracking and special work.



Wood hog—for wood refuse, bark, pulp and rechipping.

Centrifugal roll and beater mills for fine grinding of dry products up to 300 mesh. Air separation.



Jaw crushers for preliminary crushing of rock, gravel, asphalt rock, ore and many other materials.

GRUENDLER PATENT CRUSHER and PULVERIZER CO., *St. Louis, Mo.*

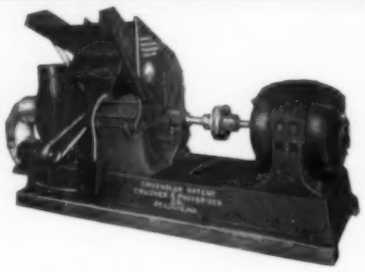
We are interested in your improved equipment for the field, checked below. Without obligation on our part, please send us complete information on:

- ☐ General Purpose Crushers and Pulverizers.
- ☐ Coal Crushers and Pulverizers.
- ☐ Bone, Tallow and Cracklings Grinders.
- ☐ Heavy Chemical Crushers and Pulverizers.
- ☐ Alfalfa Grinding Machinery.
- ☐ Screenings and Bran Pulverizers.
- ☐ Custom Grinding Machinery.
- ☐ Cement and Rock Crushers.
- ☐ Rock and Gravel Crushers.
- ☐ Crushers for By-Product Coke Plants.
- ☐ Wood Hogs and Shavings Pulverizers.

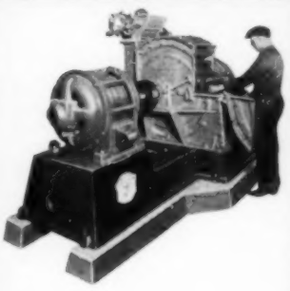
Name .....

Firm .....

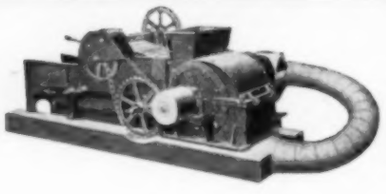
Address .....



Whirl beater for custom feed grinding. Hammer type with built-in spout magnet.



Peerless fine grinder. Grinds shavings into sawdust or wood flour; also bran, grain and mixed feed.

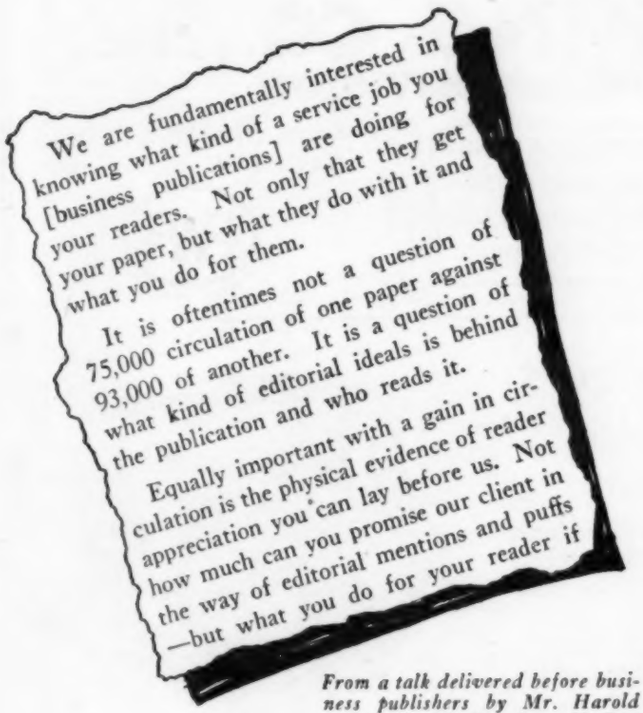


Shredder with hopper and force feed table—for hay, waste paper, cornstalks, ear corn, etc.

Portable pulverizers for crushing limestone, coal, gravel, etc.

This is one of a series of McGraw-Hill advertisements directed originally to advertising men in an effort to make industrial advertising more profitable to buyer and seller. It is printed in these pages as an indication to readers that McGraw-Hill publishing standards mean advertising effectiveness as well as editorial virility.

More and more advertisers are asking this question daily


We are fundamentally interested in knowing what kind of a service job you [business publications] are doing for your readers. Not only that they get your paper, but what they do with it and what you do for them.
It is oftentimes not a question of 75,000 circulation of one paper against 93,000 of another. It is a question of what kind of editorial ideals is behind the publication and who reads it.
Equally important with a gain in circulation is the physical evidence of reader appreciation you can lay before us. Not how much can you promise our client in the way of editorial mentions and puffs —but what you do for your reader if

From a talk delivered before business publishers by Mr. Harold W. Cook, N. W. Ayer & Son.

THIS viewpoint typifies the trend from old "space-buying" methods to careful, behind-the-scenes investigation of advertising mediums . . . a trend that is welcomed by those business publishers who are insistent upon a virile, courageous editorial service to their readers.

This question, "What lies behind your circulation figures?" is easily answered by McGraw-Hill readers. Advertising men have been given a definite answer to this query in the form of a series of advertisements published during 1928, in which is described real editorial service, its objectives and results.

Our advertising agent dug deeply into McGraw-Hill editorial records to help other advertising agents and their industrial clients answer this question.

—The publishers

Reprints of these advertisements will be sent upon request to industrial advertisers, industrial salesmen, advertising agents, bankers and collegiate schools of marketing and advertising.

F-4

1928			
Jan.	Feb.	Mar.	Apr.
May	June	July	Aug.
Sept.	Oct.	Nov.	1929

One Year's PROGRESS

With the closing month of 1928, we can look back on a number of new designs and improvements that mark real progress in our job of keeping pace with the machinery requirements of the Process Industries.

Among these are:—the adoption of Timken roller bearings on some of our heavy duty "Universal" Mixers—improved stuffing box design — improved method of obtaining temperature readings in closed machines—electrically heated mixers—improvements in special machinery for dispersing, dissolving, and diluting.

To all our good friends and clients, a happy and prosperous New Year!

On our part, a renewed pledge for further advance in modern machine design.

BAKER PERKINS CO., Inc.

WERNER & PFLEIDERER DIVISION

250 Park Avenue
NEW YORK
2004 Conway Bldg.
CHICAGO
901 Pacific Bldg.
SAN FRANCISCO

MACHINERY FOR MIXING & KNEADING
MASTICATING, PULPING & SHREDDING
DILUTING, DISSOLVING & DISPERSING
RUBBER WASHING & COMPOUNDING

MAIN OFFICE & WORKS
SAGINAW, MICHIGAN

Braun Laboratory Pulverizers

give quicker and better service over longer periods of operation

While particularly adapted for metallurgical samples, Braun Pulverizers are also giving unequalled results in the industrial laboratory.

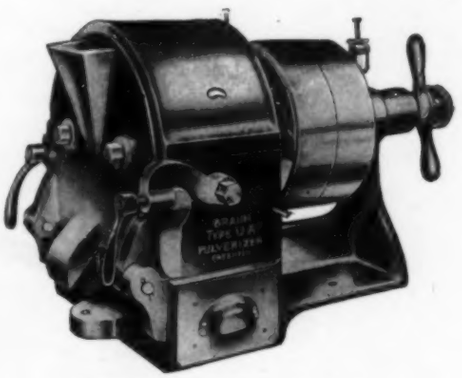
Machine will pulverize a wide variety of materials and reduce them to any desired mesh.

On a recent test with quartz ore, previously crushed to ¼ inch, the Braun Pulverizer has a record of *one pound* pulverized with *one grinding* to *one hundred mesh* in *one minute.*

Straight drive—no gears, replaceable bearings of anti-friction metal. Grinding plates of special alloy. All parts easily cleaned.

Shipping weight 275 lbs.

Price f.o.b. factory Los Angeles, $135.00.



BRAUN Products Include:

Chipmunk Crusher, U A Pulverizer, Iron Ore and Coal Grinders, G-H Consistency Testers, Electrolytic Outfits, Furnaces—Muffle, Crucible and Combination, Flotation Test Machines, Rotarex Asphalt Tester, Oil Stills, Evaporators and Samplers.

BRAUN Service Includes:

Zinc Savings
Cyanide
Sodium Sulphide
Borax Glass
Mercury
Calmix Cupels
Pyrex Glassware
Crucibles
Chemicals and Reagents

The Braun Corporation

363 New High Street ~ Los Angeles

San Francisco House, Braun-Knecht-Heimann Co.

MANUFACTURERS OF THE HERMAN SCREENING BALL MILL

BRAUN LABORATORY APPLIANCES—*Standard the World Over!*

Knights were Bolder with Welded Swords

Special Alloy

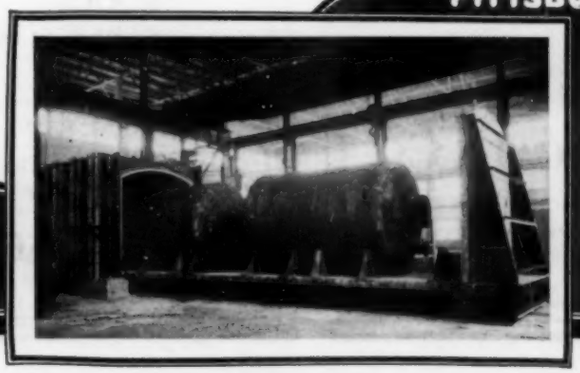
TOLEDO and Damascus swords were famous throughout all antiquity for marvelous strength and toughness. No knight felt fully equipped until he had one. They were made by a process of repeated welding, which refined the steel and developed its strength as no other process could. Today, Blaw-Knox, by forge and hammer welding—a scientific refinement of the process used by blacksmiths since Tubal Cain—produces one piece bottle-tight pressure vessels. Blaw-Knox is welding headquarters. It offers you a fully equipped modern plant and an experienced engineering department to design and fabricate every variety of welded plate construction. Forge and Hammer, oxy-acetylene and electric welding methods are used as good practice dictates.

WELDING HEADQUARTERS

BLAW-KNOX COMPANY

PITTSBURGH, PENNA.

Blaw-Knox Forge and Hammer Welded Pressure stills being annealed in large annealing furnace 12'x12'x 50'.



"WEIGH"

to simultaneously control operations and SAVE . . .

1. Time
2. Labor
3. Materials

Production Control

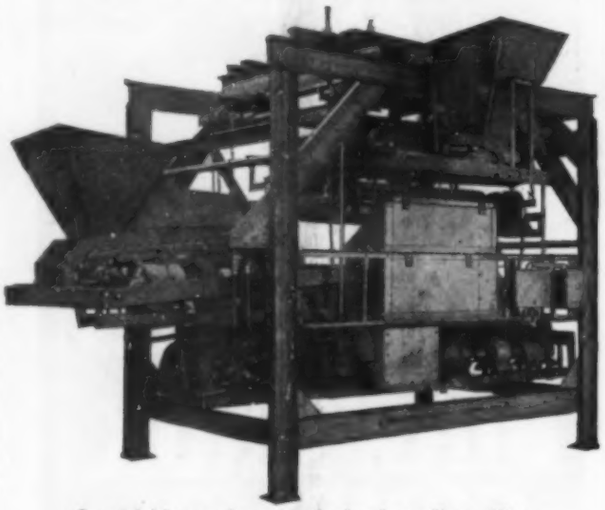
In order to manufacture perfect products it is necessary to know just how much "raw material" is put into the process and how much completed product is obtained.

RICHARDSON AUTOMATIC SCALES

weigh materials going into production and give accurate records— without human assistance— of manufacturing costs. Likewise, Richardson Automatic Scales accurately record the amount of finished *bulk* product and *save time and labor* in *sacking* materials.

Process Control

The Richardson "CONVEYoWEIGH"



for weighing and proportioning ingredients like coal, clinker, gypsum, coke breeze, carbon mix, bauxite, barytes, chemicals, rock, etc., are indispensable where perfect products are needed.

Ask for your copy of our new Catalog No. 1629-E which is now ready for distribution.

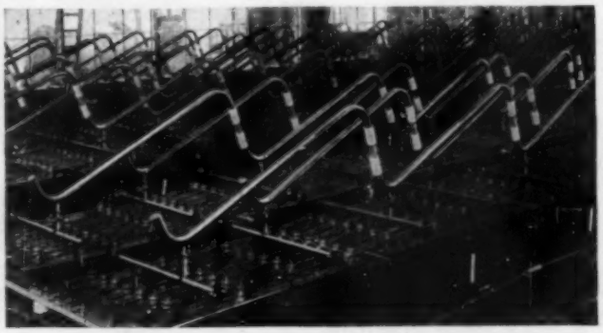
RICHARDSON SCALE CO.

CLIFTON, N. J.

NEW YORK BOSTON PHILADELPHIA PITTSBURGH
CHICAGO ATLANTA GULFPORT MINNEAPOLIS
LOS ANGELES OMAHA WICHITA

HYDROGEN

KNOWLES ELECTROLYTIC PLANTS
for high purity and low cost production



Installation of 50 No. 13 "EYEOSEE" Knowles generators at a Pennsylvania Steel Plant, where both the hydrogen and oxygen are used for cutting purposes.

Normal 24-hr. productive capacity at 2,000 amperes, 20,000 cu.ft. of 99.75% pure oxygen and 40,000 cu.ft. of 99.95% pure hydrogen. Can be operated at 3000 amperes at slightly higher voltage to produce 50% more of each gas.

Our experience as American Manufacturers and Distributors enables us to recommend these plants unqualifiedly.

Write for literature.

INTERNATIONAL OXYGEN COMPANY

NEW YORK
VERONA (Pittsburgh), Pa.
I.O.C. SYSTEM INDUSTRIAL GASES
TOLEDO, O.
BUFFALO, N. Y.

MAIN OFFICE: NEWARK, N. J.

New England Division:
THE TARIFFVILLE OXYGEN CO., TARIFFVILLE, CONN.

SEMET-SOLVAY

PROTECTIVE PAINTS

TO MEET ALL CONDITIONS OF EXPOSURE ON

IRON AND STEEL

BRIDGES
CORRUGATED IRON
FENCES
HOT STACKS
UNDERGROUND PIPING
ROOFS
STRUCTURAL STEEL
TANKS

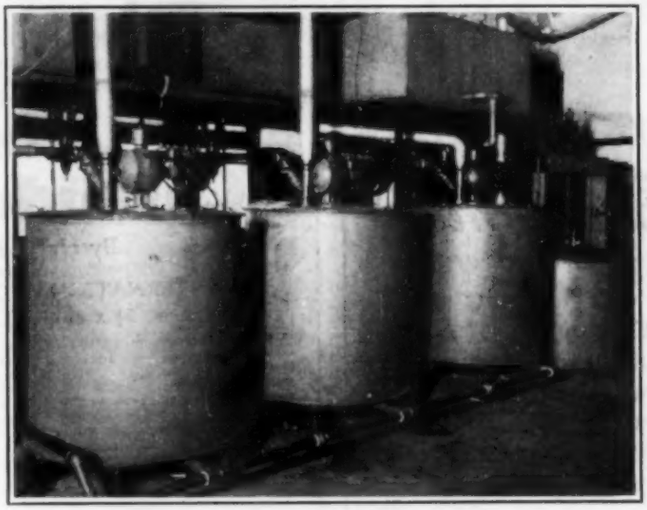
A SPECIAL PAINT FOR EACH PURPOSE

WRITE FOR
LITERATURE—SAMPLES—PRICES

SEMET-SOLVAY CO.

61 BROADWAY NEW YORK CITY

NEHCO Process—Container Resistance Electric Heating *revolutionizes oil* and *varnish production* methods and again proves that the *Nehco* process of electric heating reduces manufacturing costs



NEHCO PROCESS
AUTOMATIC ELECTRICALLY HEATED VARNISH PLANT—600 gal. per hour capacity

The use of the NEHCO PROCESS eliminates fire hazard and danger—reduces labor 50 to 70% and with its high speed and absolute time and temperature control assures the maximum production of a uniform and highest quality product at the minimum overall cost.

Rapid and uniform heating with close automatic control, large capacity, low maintenance costs and a greatly reduced overall cost have been effected by this installation.

The National Electric Heating Company will be glad to analyze your present overall cost of operation and show you where and how much money a modern NEHCO installation will save.

Investigate the NEHCO PROCESS for distillation, evaporating waste liquors, sugar, alkalies; chemicals; vegetable oil treatment, bleaching, deodorizing, bodying; varnish and oil manufacture.

NEHCO EQUIPMENT

ELECTRICALLY HEATED

ROLLS and DRUMS
for drying paper, textiles, chemicals, food products.
KETTLES
varnish, reaction, process.
TANKS
impregnating, heating, melting, reaction.
STILLS
oil, water, chemicals.
PIPE, PUMPS and VALVES
for any material or temperature
EVAPORATORS
pan, high temperature tubular, film, flash.
DRYERS
for any purpose, material or temperature.

Working temperature up to 800° F.—regulation within 2° F.

National Electric Heating Company
420 Lexington Avenue, New York City

Lick

the hard to clean plant problem!

YOU can capture that dust and dirt that escapes the broom. You can "get to" those inaccessible places—under benches, in and around equipment—radiators, flues, piping, walls, ceilings. You can keep the plant immaculate, sanitary, fit for workers—with this Sturtevant Vacuum cleaner.

Into a dust container the strong suction of the Sturtevant pulls every speck of dust or dirt. It's there to stay—until emptied. No more stirring up of dust—no dust to settle again. Time and labor saved—real cleanliness assured—fire hazards lessened.

Thousands of concerns have solved the "hard-to-clean" plant problem with Sturtevant Vacuum Cleaners. Why not you, too? Our nearest office will gladly send you complete information.

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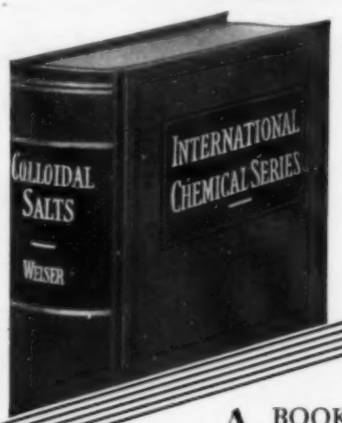
What is the status of present-day information on the Colloidal behavior of Salts?



A BOOK for research workers and students emphasizing the role of the salts in the study of colloid chemical phenomena and the theory underlying their technical applications.

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THE Colloidal Salts

By Harry B. Weiser
Professor of Chemistry, Rice Institute
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404 pages, 5½ x 8, 40 illustrations, $5.00 postpaid

AFTER a chapter dealing in a general way with the conditions of formation of colloidal salts, separate sections are given over to the colloidal sulfides, sulfates, halides, complex cyanides, silicates, and miscellaneous salts. The first portion of each section is devoted to a critical survey of the colloidal characteristics of the individual salts and the second portion to the general theory of the applications which are concerned with their colloidal behavior.

Some of the topics of general interest—

—action of electrolytes on Arsenic Trisulfide Sol;
—prevention of darkening of Zinc Sulfide Pigments;
—mechanism of the phosphorescence process;
—setting of plaster of Paris;
—the Silver Halides in Photography;
—Ionic Antagonism in biological systems;
—colloid chemistry of glass;
—origin, composition and properties of clay.

Chapter Headings

PART I.—COLLOIDAL SULFIDES.
I.—The Formation of Colloidal Salts.
II.—Colloidal Arsenic Trisulfide.
III.—The Colloidal Sudfides of Antimony, Bismuth, Tin, and Lead.
IV.—The ColloidalSudfides of Copper, Silver, and Gold.
V.—The Colloidal Sulfides of Zinc, Cadmium and Mercury.
VI.—The Colloidal Sulfides of Iron, Nickel, Cobalt, Manganese and the Rarer Elements.
VII.—Pigments.
VIII.—Lithopone.
IX.—Flotation of Ores.
X.—The Phosphorescent Sulfides as Colloid Systems.

PART II.—COLLOIDAL SULFATES.
XI.—The Colloidal Sulfates of Barium, Strontium and Lead.
XII.—Gypsum—Plaster of Paris.

PART III.—COLLOIDAL HALIDES.
XIII.—The Colloidal Halides of Silver, Lead, and Mercury.
XIV.—The Silver Halides in Photography.

PART IV.—COLLOIDAL FERRO-CYANIDES.
XV.—The Colloidal Ferrocyanides.
XVI.—Prussian Blue.
XVII.—Permeability of Membranes —Ultrafiltration—Dialysis.
XVIII.—Ionic Antagonism in Colloid Systems.

PART V.—COLLOIDAL SILICATES.
XIX.—Silicate Sols and Gels.
XX.—The Colloid Chemistry of Glass.
XXI—Clay.

PART VI.—MISCELLANEOUS COLLOIDAL SALTS.
XXII.—The Colloidal Carbonates, Phosphates, Chromates and Arsenates.

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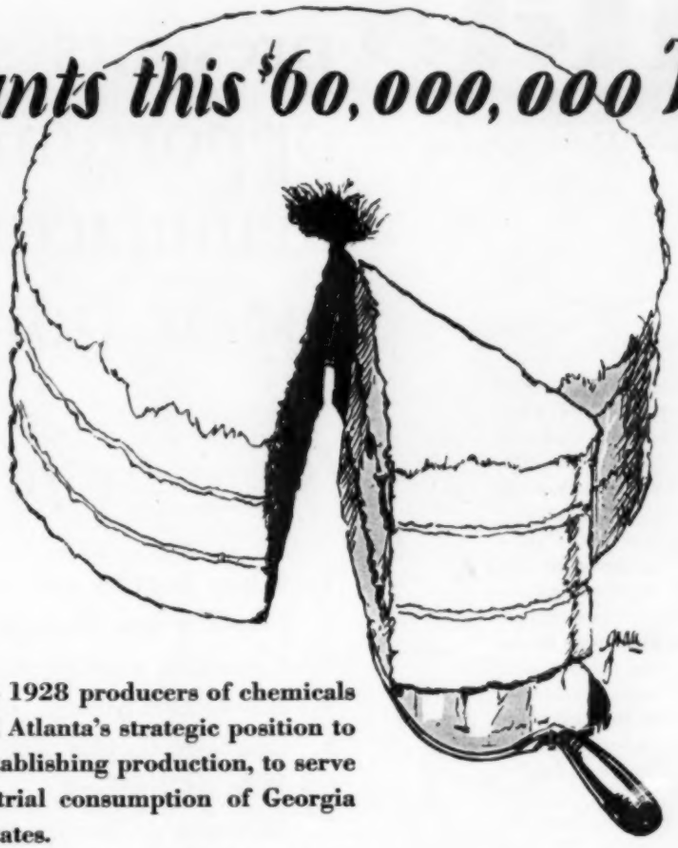

DURING 1928 producers of chemicals have recognized Atlanta's strategic position to the extent of establishing production, to serve the huge industrial consumption of Georgia and adjoining states.

In the same period the demand has increased in the same area. New industrial development has increased the *deficit* of chemical production in this section—and 1929 will see an even greater opportunity for profit in this field.

Atlanta is the nerve center of a district whose chemical needs exceed by *sixty millions of dollars a year the chemical production within the area.* Atlanta is at the heart of a raw material area whose possibilities are tremendously enhanced by the low prices and ready transportation available.

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Send for this Booklet!

It contains the fundamental facts about Atlanta as a location for your Southern branch.

* * *

The Atlanta Industrial Bureau has completed a basic study of the chemical situation. At your request a supplementary, first-hand survey will be made of the situation as it applies to your special field.

This valuable service is rendered without charge or obligation, and in the strictest confidence. A report will be prepared for your eyes alone if you will write

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Dallas

Industrial and Distribution Center of the Southwest—Twelve Million People —Six Billion Dollar Market

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6. Men's Clothing
7. Women's Clothing
8. Cotton Goods
9. Knit Goods
10. Dyeing and Finishing
11. Cotton Small Wares
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- ☐ 2. The Southwest—Six Billion Dollar Market
- ☐ 3. Dallas—Distribution Center
- ☑ 4. Industrial Survey of Dallas
- ☐ 5. Dallas as a City in Which to Live
- ☐ 6. The Growth of Dallas
- ☐ 7. Texas Corporation Laws

Today's Trend—
SMALL TOWNS
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THE necessity for locating manufacturing enterprises in big cities has largely disappeared. Present-day transportation facilities and widespread electric power distribution have marked the end of concentration of industry—and opened up to the manufacturer the tremendous advantages of the small town for factory location.

The small town factory avoids inflation of labor costs. Living is cheaper; a moderate wage scale buys more for the worker than high wages in the big city. Healthier workers, free from the fatiguing effects of a congested environment, are more productive and more efficient. In the small town the factory pays less for land and less in taxes. It has greater space at lower cost, and room for expansion is readily available. Shipping and traffic congestion is avoided.

No better opportunity for cost reduction exists today than the elimination of the high toll of big-city congestion. The Middle West Utilities System, providing electric power to more than three thousand small and medium-sized communities, offers its assistance in determining advantageous locations for factories. Address *Industrial Development Department, Middle West Utilities Company, 72 West Adams Street, Chicago.*

MIDDLE WEST UTILITIES COMPANY

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Box Numbers in care of any of our offices count 10 words additional in undisplayed ads.

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POSITIONS VACANT

CHEMICAL or metallurgical engineer (single) preferably with furnace experience, for work at Nitrate Plant, Chile, South America, salary $250 monthly; three-year contract, transportation both ways and salary while traveling paid by company. Give complete details in first letter. P-240, Chemical and Metallurgical Engineering, Tenth Ave. at 36th Street, New York.

CHEMIST: Man with some experience in enameling and foundry control work desired. Good opportunity for right man. Give age, technical training, etc. P-246, Chemical and Metallurgical Engineering, 7 South Dearborn St., Chicago, Ill.

EXECUTIVE chemical engineer. Large Middle West Corporation, manufacturing a variety of wood, metal and plastic (rubber, shellac, celluloid, etc.), products, has an opening for capable executive chemist or chemical engineer to direct development and control work in laboratory. State age, education, experience, salary expected, time of availability and give references. P-254, Chemical and Metallurgical Engineering, 7 South Dearborn St., Chicago, Ill.

MANAGER wanted. An established successful business producing citric acid lemon oil and pectin from unsalable lemons. Volume one million and quarter dollars, about one hundred fifty men. Experience in our line not demanded but applicant must have proven executive ability and successful production experience. Others please not apply. Beginning salary five thousand dollars. State age, training experience, race, references first letter. Address California Fruit Growers Exchange, Ontario, California.

POSITIONS VACANT

WANTED: Chemist capable of doing both analytical and research work. Vacancy is in a petroleum refinery, analytical and research department. P-245, Chemical and Metallurgical Engineering, 7 South Dearborn St., Chicago, Ill.

WANTED for large works in Eastern States young chemical engineer experienced in the treatment of large volume of zinc solutions for the manufacture of pigments. P-249, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

WANTED: Patent lawyer or technologist Want services of patent lawyer or technologist to study oil cracking processes with particular reference to patent claims. Some previous knowledge of oil cracking patents required. P-248, Chemical and Metallurgical Engineering, 7 South Dearborn St., Chicago, Ill.

EMPLOYMENT SERVICE

IF you are qualified for position between $2,500 and $25,000, and are receptive to negotiations for new connection, your response to this announcement is invited. The undersigned provides a thoroughly organized service, established nineteen years ago, to conduct confidential preliminaries, and assist the qualified man in locating the particular position he desires. Not a registration bureau. Retaining fee protected by refund provision, as stipulated in our agreement. Send name and address only for description of service. R. W. Bixby, Inc., 260 Main Street, Buffalo, New York.

$3,000.00-$30,000.00 men find our service effective in making connections; individual; confidential; refund agreement; not agency. Jacob Penn, Incorporated, 9 Park Place, New York.

POSITIONS WANTED

ANALYTICAL CHEMIST — Thoroughly experienced in analysis of inorganic industrial and metallurgical materials. Age 30; married. PW-244, Chemical and Metallurgical Engineering, Tenth Ave. at 36th Street, New York.

ANALYTICAL chemist; thoroughly experienced in inorganic chemical analysis, 8 years' practical work on ores, slags, ferro-alloys, steels, refractories, and other metallurgical materials, desires permanent responsible position. Technical graduate, 28 years old, married. Experienced in laboratory management, and can equip laboratory. References gladly furnished. PW-251, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

ASSISTANT to manager or chief engineer —Energetic young engineer, thoroughly experienced on design, erection and maintenance of industrial and chemical plants, with particular reference to furnaces, drying and material-handling equipment, desires responsible position. PW-220, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

CHEMICAL engineer, age 25, university graduate; two years' experience in chemical work; at present employed; desires work of engineering nature or in ceramic, glass or refractory field; prefer location in South. PW-139, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

CHEMICAL engineer and production manager. Eighteen years' experience with vegetable oils, refining, bleaching, deodorizing and hydrogenation. Manufacturer of soft and liquid soaps, mayonnaise, lard, compound, neutral lard, salad oil. PW-247, Chemical and Metallurgical Engineering, 7 South Dearborn St., Chicago, Ill.

CHEMIST with sixteen years' research, development, and engineering experience, at present employed in executive capacity, desires permanent connection in industrial work where opportunity for advancement is commensurate with effort and ability. Prefer Middle West, but will consider any location. PW-250, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

Available

A man—

A man, of middle age and accustomed to responsibilities, desires to increase and enlarge his scope of operations. His principal reason for wishing to change is the slowing up in activities of his present connection in so far as new developments are concerned, current operations being merely of a routine nature.

Experience has been mainly along Chemical and Electrometallurgical lines, from research to the practical development of processes and appliances in connection therewith. It includes every activity connected with the operation and management of a large plant.

The advertiser seeks a connection with an enterprising concern having possibilities for development and prefers an association along lines with which he is familiar, although other opportunities will be carefully considered. Present salary is above $10,000 a year.

P-239, Chemical and Metallurgical Engineering
Tenth Ave. at 36th St., New York City

POSITION WANTED

A chemical engineer of ten years' experience in chemical and metallurgical processing. His experience covers research, development, and management.

He has a constructive record of achievement:—he has improved process and quality, increased production, smoothed operation, and lowered costs. He is thoroughly familiar with plant design, equipment and operation.

He has more than an engineering education. While he holds degrees of A.B., and Ch.E., following graduate study, he has not been limited by them. He is a scientist by training, a chemical engineer by experience, a plant manager by inclination.

He has made substantial progress in his present position but believes that his future here is limited. He is only interested in a position offering opportunity for development.

PW-238, Chemical & Metallurgical Eng.
Tenth Ave. at 36th St., New York City

To Employers Who Advertise for Men:

The letters you receive in answer to your advertisements are submitted by each of the applicants with the hope of securing the position offered.

When there are many applicants it frequently happens that the only letters acknowledged are those of promising candidates. Others do not receive the slightest indication that their letters have even been received, much less given any consideration. These men often become discouraged, will not respond to future advertisements and sometimes even question if they are bona fide.

We can guarantee that *Every Advertisement Printed in the Searchlight Section Is Duly Authorized.* Now won't you help keep our readers interested in this advertising by acknowledging every application received, even if you only return the letters of unsuccessful applicants to them marked, say, "Position filled, thank you." If you don't care to reveal your identity, mail them in plain envelopes.

We suggest this in a spirit of helpful co-operation between employers and the men replying to Positions Vacant advertisements.

Searchlight Department

McGRAW-HILL PUBLISHING COMPANY, INC.

"Put Yourself in the Place of the Other Fellow"

POSITIONS WANTED

CHEMICAL equipment sales engineer. I am a chemical engineer with 18 years' manufacturing and selling experience. For years with a well known maker of chemical machinery. Known to the chemical and process industries as an authority on equipment and corrosion resisting materials. Well fitted for position of sales manager, sales engineer, plant manager or buyer. Exceptional references. If you need a man of the above qualifications write to PW-241, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

CHEMIST, 36, with a very broad and successful experience in the technical development and commercialization of new products and processes, desires to change to responsible executive position; best references in American chemistry and in banking circles for strong personality; technical knowledge, sales resource, good business sense and personal integrity; linguistic ability, tactful and agreeable personality. PW-217, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

CHEMIST, experienced development, research and operating man, desires technical position leading to executive work. PW-243, Chemical and Metallurgical Engineering, Tenth Ave. at 36th Street, New York.

CHEMIST, age 33, single, trustworthy, able, best of references, I.C.S. man; 8 years analytical, assaying, operating and manufacturing experience; can also do research in any line, desires position in any location; please explain duties. 23-19 27th St., Astoria, N. Y.

COLLEGE graduate, engineering metallurgy, wants good opportunity go South America; excellent Spanish; read blueprints; available at once. PW-210, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

GRADUATE ENGINEER (mining), age 35, member American Chemical Society, with considerable knowledge of industrial chemicals, technique and economics, desires position as California representative for a large, well established firm handling chemical products. Excellent character references. PW-253, Chemical and Metallurgical Engineering, 883 Mission Street, San Francisco, Calif.

EXECUTIVE chemist Ph.D., organic, 16 years' varied industrial research, development, production and business experience, seeks permanent responsible engagement rquiring special qualifications for executive ability and high proficiency combined with capacity for understanding of, and adaptation to, commercial ends involved. PW-255, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

MANAGER or production superintendent; 25 years' extensive experience with different firms in various phases of dry battery manufacture. Highest recommendations. Will settle anywhere if salary warrants. PW-179, Chemical and Metallurgical Engineering, Tenth Ave. at 36th Street, New York.

SITUATION wanted by graduate chemist, age 31, married, seven years' experience on ferrous and non-ferrous metals, drug assay, coal and miscellaneous analyses; ability to take charge of laboratory; salary $3,000. PW-211, Chemical and Metallurgical Engineering, 7 So. Dearborn St., Chicago, Ill.

SUPERINTENDENT or assistant manager's position desired by chemical engineer with 12 years' experience in process industries. PW-242, Chemical and Metallurgical Engineering, Tenth Ave. at 36th Street, New York.

PRODUCTION or development executive, chemical engineer, age 35; a successful record of more than 10 years in development and production of a wide variety of products; a capable organizer and business executive with originality and vision tempered by good, sound judgment; now employed but seeking broader fields. PW-235, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

BUSINESS OPPORTUNITIES

INQUIRIES solicited from corporations interested in raising capital through marketing of corporate securities. Brookworth, Inc., 110 E. 42nd St., New York.

Clients Seek Patents or Inventions

Covering chemical or metallurgical processes preferably directed to recovery of waste-products. Samuel H. Dolbear, Consulting Engineer, 17 Battery Place, New York.

Organization Wanted

For converting low grade zinc and manganese ores into valuable sulphates, oxide chlorides and manganese fertilizer. Box 513, San Rafael, Calif.

WANTED

Efficient Expert for the Sale of Special Centrifugal Machines for the Chemical Industry in the U. S. A.

Best connections to the possible users essential. Apply with full particulars, giving references, to

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Engine Generator Set

A direct connected D.C., about 500 kw. shunt wound, 250 volts. Give engine and generator specifications, age, price and where inspection can be made.

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We pay highest market price, make prompt returns and hold goods for your approval.

I. MILLER, Smelter and Refiner
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What Do You Manufacture?

Your industry can usually find some items in our large stocks always ready for shipment that will help you in increasing plant production, replacing worn out equipment or lowering maintenance costs. A few representative industries which we can serve are listed below.

SULPHURIC ACID

Remaining from the contact plants at Old Hickory we have on hand the following items:
42-in. Steel Scrubbing Towers.
42-in. Steel Absorber Towers.
Cast Iron Pipe Cooling Coils.
Cast Steel Tower Tops.
Cast Steel Elbows.
Cast Iron Fittings.
Submerged Acid Pumps.
Preheater Tubes.
Preheater Castings.
Pressure Filter Tanks.

NITRIC ACID

Hart Condenser Tubes.
Duriron Pipe.
Duriron Manifolds.
Duriron Fittings.
Chemical Ware Pipe.
Chemical Ware Fittings.

NITRO-CELLULOSE

10—American Machine Tool Co., 42-in. Wringers, complete with dipping pots, agitators, motors, pipe, valves and fittings.
Also building steel work. We can furnish complete units or any parts for spares or replacement.
15—40 hp. Vertical motors for above wringers.
50—Gear and Pinion Agitators for 12-ft. dia. boiling tube.
10—Cast Steel outside type Kutztown 3-in. acid pumps for mixed acid.
10—4-ft. 6-in.x24-ft.—½-in. plate, Steel pump tanks for recovery and circulation of nitric and mixed acid.
4—24-in. Pot wringers with fume jackets.
20—Complete wringer heads for 42-in. wringers.
4—Sargent 48-in. Mixing pickers for cotton linters.
6—30 hp. Back geared motors with silent chain and gears for agitator drive.

AMMONIA LIQUOR

AMMONIA STILL

1—Cast Iron Ammonia Still, 4-ft. 6-in.x4-ft. 6-in. square by 26-ft. 6-in. high. Made in sections with boiling caps. Has lime leg 2-ft. diameter x 9-ft. high. Preheater coils, condenser concentrator, lime mixing tank, feed tank and pumps. A practically new and complete ammonia plant.

AMMONIA CONCENTRATOR

1—Aluminum concentrator for ammonia. Six sections all complete. Overall dimensions 24 ¾ x20 ⅞ x22 inches.

TAR EXTRACTOR

1—Tar Extractor. Length 8-ft., width 5-ft. 2-in., height 8-ft. Made from steel plate ¼-in. thick throughout. Securely riveted and braced to be gas tight. Fitted with four series of steel plates with 7/32-in.x15/32-in. slotted holes and 1/16-in. diameter holes, staggered to interrupt flow of gas. Also spray plate and liquor connections, gas inlet and outlet and drain and cleanout openings.

FELD WASHER

1—Feld Vertical Centrifugal Washer, 7-ft. 0-in. inside diameter by 30-ft. 6-in. high, all complete with direct connected steam engine. A practically new outfit and in perfect condition.
The three pieces above listed make up, with their tanks and accessory equipment still available, a complete ammonia recovery plant, for use in recovery of coal by-products and the manufacture of commercial ammonia liquor, ammonia sulphate, etc.

TAR PRODUCTS

DIRECT FIRE STILLS

3—Horizontal Steel Stills, 8-ft., 3-in.x 21-ft. 1-in., arranged for direct fire. Part of shell ⅛-in. locomotive fire box steel. Complete with steel setting supports.

PRIMARY STILLS

2—Vertical Primary Stills, 11-ft. 0-in. dia. x 14-ft. 0-in. high, ½-in. plate. Complete with two steel coils of 4-in. pipe.

CONDENSERS

5—Vertical Steel Condensers for tar oils, 5-ft. 0-in. dia. x 9-ft. high. Complete with two steel coils of 3-in. pipe and decanters and all connections.

PITCH COOLERS

3—Horizontal Pitch Coolers, 7-ft. 0-in. dia. x 18-ft. long, ½-in. plate, with steam coils.

TANKS AND PUMPS

15—Oil Storage Tanks, various sizes.
15—Tar and Oil Pumps, various sizes.
The above equipment is a complete unit for the manufacture of tar oils, creosote, pitch, napthalene, etc.

BENZOLS AND OILS

STILLS AND COLUMNS

1—Stripping Still or oil column, cast iron sections, 4-ft. dia. by 23-ft. 4-in. high. Cast-iron boiling caps.
1—Steel Still, 8-ft. dia. by 17-ft. 6-in. long, ⅝-in. shell, 700 gallons capacity. Steam coil of 30—3-in. tubes in cast iron header. Rectifying column 4-ft. dia. by 5-ft. 5½-in. high, mounted on top of still. Column of cast iron with cast iron boiling caps. Pipe connections to one steel shell dephlegmator. Size 5-ft. 4-in. by 3-ft. 8⅝-in. by 5-ft. ⅝-in. steel plates, with 1½-in. dia. steel tubes.
2—Steel Still Pots, 7-ft. 6-in. dia. x 8-ft. long, 5/16-in. plate double lap riveted with 1½-in. steam coils.

SCRUBBING TOWERS

2—Scrubbing Towers 9-ft. dia. x 67-ft. high, steel plate construction with wooden grids. Complete with receiving and pump tanks, 24-in. gas pipe and connections.

CONDENSERS

1—Crude Oil Condenser, horizontal, 4-ft. diameter by 9-ft. 9-in. long, overall. Length between tube heads 8-ft. Provided with 274 1½-in. charcoal iron tubes No. 13 gauge, giving 877 sq.ft. condensing surface on outside and 750 sq.ft. surface on inside of tubes. Tube sheets are ⅝-in. steel plate.
1—Light Oil Condenser, made by Patterson-Kelly Company, 2-ft. 6-in. diameter by 15-ft. 6-in. high. Steel plate shell, with cast iron heads. There are 190 tubes 1¼-in. diameter x 12-ft. 9-in. long in ⅛-in. steel tube sheets. Inlet and outlet connections 4-in. diameter.
3—Vertical Steel Condensers, 12-ft. diameter by 24-ft. 6-in. high. Bottom ¼-in. plate, shell in five rings, three of ⅝-in. plate and two of 5/16-in. plate, tube sheets ½-in. plate. Each condenser has 770 standard gauge tubes 3-in. outside diameter by 20-ft. long giving 12,007 sq.ft. outside cooling surface. Gas inlet and outlet connections are 24-in. diameter.

HEAT EXCHANGERS

1—Heat Exchanger, oil to oil, 2-ft. 6-in. diameter by 15-in. 6-in. high. Steel plate shell with cast iron heads. There are 190 tubes 1¼-in. diameter x 12-ft. 9-in. long in ⅛-in. steel tube sheets. Inlet and outlet connections 4-in. diameter.
2—Heat Exchangers, vapor to oil and steam to oil, 2-ft. 6-in. diameter by 8-ft. high. Steel shells with cast iron heads. There are 174 tubes 1-in. diameter x 6-ft. 6-in. long in ½-in. steel tube sheets. Inlet and outlet connections 4-in. diameter.
We have one complete unit for the recovery of benzolized oils and the distillation of benzol, xylol, toluol, etc. Complete description on request.

ANILINE PRODUCTS

REDUCERS

16—Buffalo Reducers, 6-ft. 4-in. dia. x 8-ft. high. Complete with liners, plows and gear and pinion agitator drive.

HEAVY CHEMICALS

BETA NAPTHA STILL

1—Devine Beta Naptha Still. Pot 5-ft. dia. x 6-ft. deep. Receivers 2-ft. 6-in. dia. x 5-ft. long. Practically new and in perfect condition.

NITRATORS

1—Bethlehem Nitrator, 4-ft. dia. x 6-ft. deep, capacity 700 gallons. Complete with steel jacket, agitator and coner.
8—Bethlehem Nitrators, 6-ft. dia. x 10-ft. 6-in. deep. Complete with steel jacket, agitator and coners. Capacity 2200 gallons.

ACID EGGS

1—Cast Iron Acid Egg, 4-ft. dia. x 8-ft. long, 2-in. walls. Both heads flanged and bolted. Capacity 750 gallons.
2—Cast Iron Acid Eggs, 42-in. dia. x 62-in. long. Rubber lined.
3—Kellog Welded Steel Autoclaves, 3-ft. 0-in. dia. x 10-ft. 3-in. long, for 300 lbs. working pressure. Complete with jackets and settings.
1—Laboratory Autoclave, 60 gallons capacity, 150 lbs. pressure, with agitator.

FOOD PRODUCTS

COPPER TANKS

2—Open Top Copper Tanks, 8-ft. dia. x 5-ft. high. Riveted seams and bottom. Capacity 1800 gallons.
1—Closed Top Copper Tank, 30-in. dia. x 58-in. high. Capacity 185 gallons.
1—Closed Top Copper Tank, 6-ft. dia. x 7-ft. 4-in. high. Capacity 1500 gallons.
3—Closed Top Copper Tanks, 5-ft. 8-in. dia. x 5-ft. high. Cajacity 1500 gallons.

EVAPORATOR

1—Swenson Evaporator, 128 sq. ft. heating surface, with copper tubes. Shell 30⅝-in. x 4-ft. 9-in. All complete with vacuum pump and fittings. Used three weeks on syrup experiments.

FILTER PRESS

1—18-in. Sperry All Iron Filter Press, 18 plates and frames. Used three weeks.

We welcome inspection of our equipment and want you to send your engineers to look it over at any time convenient to you.

NASHVILLE INDUSTRIAL CORPORATION

OLD HICKORY, TENNESSEE

HERE IS GOOD USED EQUIPMENT READY TO HELP YOU MAKE MORE

COAL PRODUCTS

BRIQUETTING PRESSES

2—Komareck Briquetting Presses, roll and chain feed type, capacity 20 tons per hour each. Complete with direct connected motor drive. Rutledge fluxer, pitch binder, mixers and paddle mixers. Practically new.

1—Komareck Briquetting Press, capacity 15 tons per hour. Complete with drive, fluxer and mixer.

1—Belgian Briquetting Press, capacity 12 tons per hour. Complete with drive and fluxer.

BALL MILLS

1—No. 8 Marcy Ball Mill, dia. 8-ft. 0-in., length 6-ft. 0-in. Liners, shell and feed end Manganese steel. The mill is left hand type direct connected, by flexible coupling, to G. E. 250 hp. Type I 440/340/380 volts, 3 phase, 60 cycle motor.

1—Kennedy Ball Mill, dia. 8-ft. 0-in. Length 6-ft. 0-in. Liners "Herculite" steel, screen plates, manganese steel. This mill driven by belted motor, 200 hp. 440 volts, 3 phase, 60 cycle, full charge of manganese and chrome steel balls.

1—Ball Mill diameter 4-ft. 0-in. Length 8-ft. 0-in. driven from belted counter shaft, to bevel gear and pinion.

3—Williams No. 3 Patent Drop Bottom Coal Crushers, direct connected to 50 hp. motors.

We have a complete briquet manufacture and preparation plant and can furnish all or any part, including conveyors, elevators, grinders, mixers, fluxers and briquet machines. Submit your inquiries to us at any time.

MISCELLANEOUS

WRINGER

1—American 30-in. centrifugal steel basket and curb. Complete with motor drive.

ACID PROOF PUMPS

15—All iron 3-in. vertical centrifugal acid pumps Kutztown type.

30—All iron 3-in. vertical centrifugal acid pumps submerged type.

2—Cast steel vertical centrifugal acid pumps, Kutztown type.

4—Baker all iron horizontal centrifugal pumps 6-in. discharge 8-in. suction.

2—Goulds all iron submerged type, sump pumps, 2-in. discharge.

LIME HYDRATOR

1—J. P. Devine Lime Hydrator, with steel tank. Practically new and all complete.

BLOWERS

2—Connersville Blowers, size 18x20½x54-in., capacity 24-cu. ft. per revolution, direct connected to 10-in. x 10-in. Troy steam engines. Good for 1 to 3 lb. pressure.

1—Roots High Pressure Blower, size No. 3, capacity 2⅝-ft. per revolution. Good for 10 lbs. pressure.

1—Connersville Gas Pump, size 10x15x24-in. Capacity 3.3 cu. ft. per revolution.

1—Sturtevant Rotary Blower, size No. 3. Capacity 3 cu. ft. per revolution.

1—Roots Rotary Gas Exhauster, size 3¼ x 4½-in.

STEAM PUMPS

Our stock of steam pumps is very complete at this time, in both duplex and simplex. Send for complete list just issued.

CENTRIFUGAL PUMPS

Many large centrifugal pumps, suitable for water service, condenser supply; turbine and motor driven are now available. List and details on request.

STEEL TANKS AT OLD HICKORY

Qu.	Dia.	Height or Length	Capacity
10	2′ 6″	3′ 3″	119
1	3′	8′	425
1	4′	5′ 5″	510
6	4′ 3″	4′10″	510
1	4′ 6″	8′	950
15	4′ 6″	24′	2,855
1	6′	4′ 9″	1,000
4	6′	11′ 5″	1,260
2	7′ 6″	7′10″	2,340
50	8′	6′	2,256
1	20′	12′	28,200

OIL FIELD TYPE TANKS
(All Seams Bolted)

Qu.	Dia.	Height	Capacity
4	21′ 6″	7′ 9″	22,000
4	21′ 6″	15′ 6″	43,000
1	30′	16′ 2″	85,000

STEEL TANKS AT BRISTOL, VA.

Qu.	Dia.	Length	Capacity
1	4′ 4″	8′ 6″	950
1	5′	9′ 8″	1,500
1	4′ 6″	9′ 6″	1,000
1	5′	18′	2,750

STEEL TANKS AT KINGSPORT, TENN.

Qu.	Dia.	Height	Capacity
1	3′	6′	325
2	5′	4′	500
1	5′ 6″	6′	1,250
1	6′ 4″	3′ 6″	862
1	6′ 4″	4′	1,000
1	6′ 4″	10′ 6″	2,200
1	6′ 4″	11′ 6″	2,500
1	6′ 4″	13′ 6″	3,000
2	6′ 4″	14′	3,250
2	7′	11′	3,100
2	7′ 6″	8′	2,700
1	7′11″	2′ 6″	950
1	10′	8′	4,700
6	11′	9′	6,500

STEEL TANKS AT CLINCHFIELD, VA.

Qu.	Dia.	Height or Length	Capacity
6	1′ 6″	4′	50
6	2′	2′	50
6	2′ 6″	2′ 6″	92
1	3′	3′	160
3	3′	3′ 3″	175
2	3′	4′	210
1	3′	4′ 3″	225
1	3′	11′ 8″	600
1	4′	3′ 6″	325
3	4′	6′	550
1	4′	15′	1,400
1	5′	6′	1,100
5	5′	8′11″	1,100
1	7′	17′	5,000
3	7′	18′	5,200
2	7′ 6″	20′	6,000
1	7′ 9″	20′	7,000
1	8′	14′	5,000
2	8′	27′ 1″	10,000
3	8′ 3″	21′ 1″	8,000
1	8′ 6″	4′ 6″	1,900
1	10′	12′	7,000
2	11′	14′	9,700
2	12′	8′	6,000
1	12′	12′	10,000
6	19′	10′	20,000
4	19′	12′ 6″	25,000

RECTANGULAR TANKS

Qu.	Length	Width	Depth	Capacity
1	8′	4′	4′	875
1	8′ 9″	4′	4′	1,000
1	9′	8′ 7″	1′ 6″	870
1	9′10″	4′ 8″	3′	1,000
1	10′	5′	4′	1,345
1	16′	8′	4′	3,800

Know the History of Your Purchase

Then your purchase is of even more value to you. You know the length of time the machine or equipment was used, the service it was in and where used. You can judge for yourself its condition and with our guarantee of serviceability you are doubly certain of a good value. No matter how low the price, no machine is a good buy unless its condition is such as to give indefinite service and satisfaction.

The Old Hickory Plant operated less than ninety days. The equipment here is practically new. It needs no rebuilding or overhauling. It is ready for service and will last as long as any new equipment you might buy. Other plants purchased by us operated from six months to one year. Everything from them in mechanical and chemical equipment is in the very best condition and has years of good service left in it. The Clinchfield Carbocoal Plant, which we are now dismantling, operated only six months and high grade equipment from it comprises many of the offerings on our lists today.

Other exceptional values are at our storage yards at Kingsport, Tenn., and Bristol, Va., where equipment is stored from plants that have recently been dismantled. We have four supply points and only high class equipment is located at everyone of them.

NASHVILLE INDUSTRIAL CORPORATION

OLD HICKORY, TENNESSEE

MACHINERY BARGAINS

FOR SALE

Kettles and Mixers

2—20 gal. Experimental Kettles.
3—30 gal. Jacketed Copper Kettles.
2—40 gal. Enamelled Jacketed Pans.
1—50 gal. Experimental Mixer Kettle.
150—"Wear-Ever" Aluminum Jacketed Kettles, 40, 60 and 80 gals. capacity.
3—100 gal. Jacketed Mixer Kettles.
2—150 gal. Jacketed Valleiron Mixers.
4—250 gal. Jacketed Copper Kettles.
2—500 gal. C. I. Sulphonator Kettles.
1—800 gal. C. I. Reduction Kettle.
1—950 gal. Jacketed Steel Kettle.
5—1600 gal. C. I. Reduction Kettles.
4—1600 gal. Nitrator Mixers.
1—2000 gal. Jacketed C. I. Mixer.

Distilling Apparatus

1—50 gal. Jacketed Copper Still.
1—75 gal. Jacketed Copper Still.
3—100 gal. C. I. Stills; Stirrers.
4—115 gal. Aluminum Jacketed Stills.
8—Steel Stills, 150 to 2000 gals.
3—400 gal. Copper Stills.
6—Rectifying Copper Columns, 15 in. and 18 in. and 24 in. diam.
7—Dephlegmators, 15 in. and 18 in. diam.
9—Condensers, assorted sizes.
3—Stills or Retorts, 6 ft. dia. x 7 ft. deep; 7/16 in. steel.

Filters

1—30 in. Sperry C. I. Filter Press.
1—30 in. Shriver-Atkins C. I. Filter Press.
6—30 in. sq. Wooden Filter Presses.
5—24 in. sq. Wooden Filter Presses.
2—24 in. sq. Cast Iron Filter Presses.
3—18 in. sq. Wooden Filter Presses.
1—30 in. dia. Steel Pressure Filter.
20—30 in. Filter Press Skeletons.
2—Kiefer Multiple Filters.
1—Vinegar Filter with Pump & Motor.

Vacuum Pumps

20—Beach Russ Rotary Vacuum.
2—Devine, 4x6 in.
1—Stokes, 2-stage 6x3 in.
1—Devine, 5x10x8.
1—Blaisdell, 14x10 in.; belted.
1—Alberger, 8x16x10.
1—Pennsylvania, 14x5 in.

Evaporators

1—Devine Vacuum Evaporator.
4—Jacketed Evaporating Pans, 7 ft. dia. x 30 in. deep.
2—Zaremba Evaporators, 5 ft. dia.
2—Evaporating Pans, 8 ft. dia. x 3 ft.

Mills and Grinders

5—Abbe Mills, 24x30 in., 4x5 ft.
1—Allis-Chalmers Rotary Hammer Mill.
1—Jeffrey Spike Roll Coal Crusher.
1—Gruendler Rotary Hammer Mill XXXX.
2—Ross Paint Mills, 20 in. dia.

Miscellaneous

3—Grinnell Dryers; NEW.
8—Centrifugal Extractors, 12 in. to 40 in.
2—DeLaval Clarifiers, No. 600.
2—Laundry Ironers, Gas-Electric.
1—150 gal. Valleiron Autoclave.
6—Refrigeration Units, 2 to 15 ton.
4—Lehmann Cocoa Bean Roasters.

MACHINERY & EQUIPMENT CO., INC.

OFFICE, WAREHOUSE and YARDS, 225-231 Sherman Ave., Newark, N. J.

Telephones 7707 and 7708 Waverly

BLOWERS

Sturtevant and Buffalo, many sizes.
Roots No. 4½—3 lbs.
Root Acme 10x10.
Sirocco No. 8-9.
Sturtevant No. 4—Pressure.
Many other sizes.

COMPRESSORS

Ingersoll-Rand—Worthington—Sullivan—I.R. 210 ft., Portable, 4 cyl. gasoline engine.

9x9x8—10x12x12.	4½x4½
10x12x14 Duplex.	6x6
14x12x12 Duplex.	9x8
16x16x18 Duplex.	14x14
12x14x18 Duplex.	19½x14

CRUSHING ROLLS

24x36—14x24—16x36—30x12—28x16.

DRYERS

1—6x6-ft. Calciner.
1—6x100-ft. Rotary.
1—Devine No. 3 Vac. Shelf Dryer.
Buffalo 26. Vac. Shelf.
3x25-ft. Rotary 3x24 indirect.
Stokes Laboratory, Rotary and Vacuum.

CENTRIFUGAL PUMPS

Many Sizes and Heads
Duriron, 1½ in. and 2 in.—

3-in., 200 g.p.m., 38-ft. head, motor driven.
5-in., motor driven.
12-in., 3-stage, motor driven.
8-in., 2700 g.p.m., 75-ft. head.
8-in., 2500 g.p.m., 65-ft. head.
8-in., 1000 g.p.m., 100-ft. head.
2-stage, 1600 g.p.m., 420-ft. head.
2-stage, 1000 g.p.m., 360-ft. hd.
Other sizes and types.

PANS—PUG MILLS

5 ft. and 7 ft. Patterson Dry Pans.
6-9 ft. Amer. Wet Pans.
8 ft., 12 ft. and 14 ft. Pug Mills.

FILTER PRESSES

Devine 30 in. Iron.

COLUMBUS
Might have marvelled—

at the equipment in use today in many plants. But his judgment would be based on standards 436 years old.

It's safe to say that in a fast moving industry 15, 10 or even 5 years old may not be modern, judged efficient—for modern practice is based on low cost, highly efficient production. The modern Columbus would marvel at the fact that a lot of it hadn't been scrapped long ago.

Lawler realizes this. That's why every piece of equipment Lawler offers for sale will pass the test of *today's* needs in economy, effectiveness and serviceability.

Edw. W. Lawler, Inc., Metuchen, N. J.

L. V. R.R. & Durham Ave. Phone: Metuchen 245

FILTER PRESSES, *Cont.*

Patterson 72 leaf 24-in. diam.
Patterson 18 in. Iron.
Shriver 24 in. wood.

We Will Trade

Something we have that you need — for equipment you don't need. This is but a partial list of our stock. When you require any equipment not listed—write and see what we can offer you.

EVAPORATORS

1—Devine 36-in., with salt chamber, a complete unit.
Stokes double effect, 250 gallons per hour, single 24-in., with salt chamber.

MILLS

Patterson 24-in. and 36-in. Dust Mills.
Traylor Ball Mill 4-ft.x4-ft.
Hardinge Ball Mill, 6-ft.x22-in.
Hardinge Ball Mill, 4-ft.6-in.x16-in.

PEBBLE MILLS

30x30-in.,—36x42-in.—5x6-ft.
6x8-ft.—7 ft. 6-in.x10-ft.
Stearns-Rogers 5 ft. x 22 ft.
Smidth 4 ft. x 16 ft.
Williams Hammer Mills—several sizes.
Burr Stone 30 in. and 44 in.
Shutz-O'Neill 20 in. and 28 in.

CRUSHERS

20x10, 24x12, 9x14, 7x24, 16x9, 6x9, 36x48, 4x8.

HYDRAULIC PRESSES

1—250 T. pump and accumulator.
24x24-in. with pump and accumulator.
Other sizes and types.

STILLS

800 Gal. Aluminum.
1500 Gal. Copper.

PUMPS

12x8½x12 Amer. Bronze fitted, 250 lbs. pressure.
5x7½x10 Amer. Bronze fitted, 80 lbs.
Triplex 3x6 Duplex 8x10.
Dorr Diaphragm. NEW.
Double vertical Slip pumps.

TANKS AND POTS

Steel, Cast Iron, Wood, Many Sizes, Some New, Some Lead Lined—Air Receivers

VACUUM PUMPS

Devine—Ing.-Rand—American.	
4½x5.	8x4.
22x8-in.	6½x8x10 Wet.
6x8½x12.	10x6.
6x8.	10x9.

KETTLES, JACKETED AND AGITATED

Dopp 1 gallon.
Mott 25-50-75 gallon.
Devine 150-1,000-2,000 gallon.
Fusion Kettle 3 ft. dia. x 4 ft. rake stirred gas or oil fired.
Fusion Kettle 6 ft. dia. x 3 ft.

MIXERS

Day 60 gal. and 8 gallon change can.
Ross double arm, 50 gal.
Rockwell 250 gal. jacketed.
Westerman 250 gal. jacketed, tilting.

MISCELLANEOUS

Steel Lockers.
500 HP. Condensor.
Time Clock.
Ammonia Receivers and Cooling Coils.
Oil-fired Lead Melting Pot.
30 hp. Erie Boiler.
Centrifuges.—24 in.—30 in.—36 in. —40 in.—48 in. copper and steel baskets.
Oil Burners.
1—Simplex No. 3 Smelting Furnace.
No. 3 Crossley Power Sagger Press.
Blungers—Double and single.

WHY "CONSOLIDATED" LEADS

Because "Consolidated" maintains a complete chemical equipment stock and can quickly fill your immediate and future requirements at all times.

Because "Consolidated" is the only company in the field that has its own facilities to overhaul and rebuild each machine shipped from its shops.

Because of the "Consolidated" purchase policy of liquidating the entire equipment of discontinued plants, whereby large savings are effected and shared by "Consolidated" customers.

Because of "Consolidated's" clear-cut guarantee behind every piece of equipment shipped, a guarantee supported by a reputable, well-known concern whose rapid growth is directly attributed to the treatment extended our customers.

These are the reasons why "Consolidated" leads the used chemical equipment field.

Check this partial list carefully. Establish that "Consolidated" contact today.

AUTOCLAVES

1—250-gal., Jacketed, Agitated.

DRYERS—TRUCK & TRAY

1—Proctor Tunnel Dryer.
2—Proctor 2-truck Dryers.
1—Gordon Shelf, 800 sq.ft.
1—Proctor Truck, 800 sq.ft.
1—Proctor Truck Dryer,1200 sq.ft.

DRYERS—VACUUM SHELF —DEVINE

10—No. 12 4—No. 23; 6—No. 25; 2—No. 27; 5—No. 34; brand new, complete, 3—No. 58.

DRYERS—VACUUM SHELF —BUFF. FNDRY.

6—J 20 complete.

DRYERS—DRUM

1—4x6-ft. Stokes Atmospheric.
1—4x8-ft. Perrin Atmospheric.
2—4x9-ft. Double Drum Atmospheric.
2—4 ft. 6 in.x12 ft. Rotary Drum Atmospheric.

DRYERS—ROTARY VACUUM

1—Devine 3x15 ft.
1—Stokes 4x15 ft.
2—Devine 5x33 ft., complete.

EVAPORATORS

2—Swenson Single and Double Effect, 250 sq.ft.
1—Stokes Triple Effect, 1000 sq.ft.
1—Scott Triple Effect, 1350 sq.ft.
2—Swenson Triple Effect, 1—1750 sq.ft. and 1—3200 sq.ft.

CENTRIFUGALS—STEAM DRIVEN

4—48-in. Fletcher.
1—40-in. Tolhurst.
1—40-in. Fletcher.
1—30-in. Fletcher.

LIQUIDATIONS

Our present liquidation operations include such well known plants as—

THE FEDERAL CHEMICAL COMPANY
NITRO, WEST VA.

THE PICKERING CHEMICAL COMPANY
NITRO, WEST VA.

TIVERTON, RHODE ISLAND PLANT OF
THE PETROLEUM CHEMICAL CORP.
WAYNE WOOD PRODUCTS COMPANY
COLLINWOOD, TENN.

SPECIAL ITEMS

1—J. P. Devine 5-ft.x33-ft. Rotary Vacuum Dryer, complete.
2—J. P. Devine 5-ft.x25-ft. Rotary Vacuum Dryers, complete.
2—200 H.P. H.R.T. Ames Boilers, A.S.M.E. Mass. standard.
4—Truscon Steel Buildings.
1—54-in. Badger Column.
1—Zaremba Iron Triple Effect Evaporator, copper tubes, 1030 sq.ft. heating surface each effect.

Send for Your Copy of Our Latest "Play Safe" Circular

FILTER PRESSES — IRON AND WOOD, OPEN AND CLOSED DELIVERY, RECESSED, PLATE AND FRAME

4—Shriver and Johnson 36x36-in.
12—Shriver and Sperry 30x30-in.
2—Johnson 24x24-in.
2—Shriver 18x18-in.
1—Shriver 18x18-in., lead.
12—Shriver, Johnson, 12x12-in.

SWEETLAND FILTERS

4—No. 12; 1—No. 11; 1—No. 10; 2—No. 7; 2—No. 5; 1—No. 2.

OLIVER FILTERS

1—3x2; 3—6x4, all iron.
2—6x6, Wood Staves.
2—6x6, Acid proof.

CENTRIFUGALS — BELTED, MOTOR DRIVEN, COPPER AND STEEL BASKETS

4—60-in. Tolhurst.
3—48-in. Tolhurst.
9—48-in. Fletcher (S. & U.)
6—40-in. Tolhurst.
21—20-in. to 36-in. Tolhurst. American Laundry, Troy, etc.

W. & P. MIXERS

1—Size 8, unjacketed, 4½ gal.
1—Size 11, jacketed, 9 gal.
1—Size 14, jacketed, 50 gal.
1—Size 14, unjacketed, 50 gal.
2—Size 15, jacketed, 100 gal.
2—Size 17, unjacketed, 200 gal.
1—Size 17, jacketed, 200 gal.
1—Size 18, unjacketed, 200 gal.
1—Size 21, unjacketed, 580 gal.
1—Size 30, jacketed, 2300 gal.

MIXERS

6—5,000 gal. Vertical, Coils.
1—1,000 gal. Day, jacketed.
3—500 gal. Stokes, jacketed Dough.
2—500 gal. Day, jacketed, Jumbo.
24—Dough Mixers, 1 bbl. to 6 bbl.
6—60 gal. and 100 gal. Day Imperial.
14—Sizes A, B, C and D, Day Sifters and Mixers.
1—Each, size D-10 and size G, Day Dry Powder Sifters and Mixers.

SULPHUR BURNERS

4—Glens Falls Sulphur Burners, 4-ft. x 16-ft. complete.

KETTLES—All Types and Sizes

300 in stock—open top, closed, jacketed and unjacketed, with and without agitators, with and without copper and steel coils, vertical and horizontal.

Made of Cast Iron, Steel, Copper, Aluminum, Glass Lined, Lead Lined, Duriron and Monel Metal.

Capacities from 25 gals. to 20,000 gals.

DISTILLING UNITS

8—12-in. to 60-in. copper columns with condensers.
22—Fractionating Columns, complete, 12-in. to 84-in.

VACUUM PANS

10—Copper, 25 gal. to 600 gal.
2—100 gal. Aluminum jacketed Pans complete.
1—6-ft. Copper Vacuum Pan.
1—7-ft. Cast Iron Vacuum Pan.

CRUSHING MACHINERY

Send for your copy of latest bulletin listing Raymond Mills, Schutz-O'Neill, Sturtevant, Fuller-Lehigh, Ball and Pebble Mills, Hardinge Mills, Jaw and Gyratory Crushers, Tube Mills, Dryers and Kilns

Send us your list of surplus idle equipment. We pay spot cash for single items or complete plants!

Consolidated Products Company, Inc.

MAIN OFFICE:
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Phone: Barclay 0600
Additional Phones: Barclay 0600

SHOPS:
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Cable Code: Equipment

REBUILT EQUIPMENT FOR 1929!

CENTRIFUGALS
10—20, 26, 30, 36, 40, 42, 48, 54, and 60-in. Tolhurst, Fletcher & Amer. Laundry makes.
4—40-in. Tolhurst, Amer. Tool, Fletcher, suspended type.

CENTRIFUGES
5—No. 600 & 601 De Laval Clarifiers.
2—No. 6 Sharples Centrifuges.
1—Style A, De Laval Centrifuge.

DRYERS—KILNS
1—3-ft. x 25-ft. Bartlett & Snow.
2—5-ft. x 35-ft. American.
9—Ruggles-Coles A1 to A18.
3—6-ft.x60-ft. Bonnot.

DRYERS—TRAY AND TRUCK
1—1 Truck Gordon.
2—6 Truck, Gordon Davis, Hurricane.
3—Tray Type Proctor and Gordon, 300 sq.ft. ea.

DRYERS—VACUUM SHELF
12—Nos. 4, 5, 7, 11, 12, 20, 23, 26, 32 and 34 Devine.
6—5 to 20 shelf Buffalo & Stokes.

DRYERS—ROTARY VACUUM
2—3-ft. x 15-ft. Stokes, Devine.
1—4-ft. x 20-ft. Devine.
1—5-ft. x 25-ft. Devine.

EVAPORATORS
2—Single Effect, 200 and 1000 sq.ft.
1—Double Effect, 1000 sq.ft.
3—Triple Effect, 800 to 1500 sq.ft.

DRYERS—DRUM
1—40x60-in. Devine Bronze Vac.
1—40x80-in. Devine Vac.

DRYERS—DRUM (Cont.)
1—36-in.x108-in. Devine Double Drum. Bronze vacuum.
3—5-ft.x12-ft. Buffalo & Stokes Atmospheric.

SWEETLAND FILTERS
10—Nos. 2, 7, 9, 10, 11 and 12.

ROTARY FILTERS
6—4x4, 6x6, 8x6, 8x12 Oliver.
2—6-ft.-8-ft. American 4 Disc.

FILTER PRESSES
20—6, 12, 18, 24, 30, 36, and 42-in. sq. Wood & Iron.
5—18-in.x18-in. Shriver lead.

WERNER & PFLEIDERER MIXERS
2—Size 11 Unjacketed 9 gals.
2—Size 14 Jacketed, 50 gals.
2—Size 15 Jacketed 100 gals.
1—Size 15, Type VIII, Unjacketed.
1—Size 30 Jacketed, 2650 gals.

MIXERS
3—One bbl. Day, 50 gals.
2—100 gal. Reade & Moss.
3—50, 100 gal. Day Imperial.
1—4½ bbl. Fowler.
10—Day Dry Powder, Size A, B, C, D, F, with sifters.
10—Paste and Liquid Mixers, 50 to 300 gals.

GRINDERS
10—Schutz-O'Neill 16-in., 20-in., 22-in., 28-in.
5—Meade Mills, Nos. 1, 2, 3.

GRINDERS (Cont.)
6—Raymond Mills No. 1 No. 0, No. 00, No. 000, No. 0000.
3—Raymond, Four and Five Roll.
2—No. 2 Williams Pony Crushers.
3—Abbe, Ball and Jewell Cutters.
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5—2 Roll, Mills, 9x18-in., 12x30-in., 16x40-in.
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Chemical Plant Equipment
Bethlehem Fdry. & Mch. Co.
Blaw-Knox Co.
Buffalo Fdry. & Mch. Corp.
Corning Glass Works
Duriron Co.
Ferguson Co., H. K.
Lancaster Iron Works
Liberty Coppersmithing Co.
Research Corp.
Smith Corp., A. O.
Struthers-Wells Co.
Swenson Evaporator Co.
Walworth Co.
Williams Pat. Crusher & Pulv. Co.

Chemical Stoneware, Acid Proof
Chlorine Generators, Coils or Worms, Valves and Fittings, Crystallizing Pans, Receivers or Woulff Jugs, Cocks, Tower Parts and Pitchers and Decanting Jars, Ejectors, Cellaring Tourills, Jugs and Pots Condensing Pipe, Chamotte or Sleeve Pipe
General Ceramics Co.
Knight, Maurice A.
U. S. Stoneware Co.

Chemicals, Industrial
American Cyanamid Co.
American Solvents & Chemical Corp'n
Baker Chemical Co., J. T.
Carbide & Carbon Chemicals Corp.
Commercial Solvents Corp'n
Denver Fire Clay Co.
Diamond Alkali Co.
Mathieson Alkali Works
Sargent & Co., E. H.
U. S. Industrial Chem. Co.

Chemicals, Laboratory
American Cyanamid Co.
American Solvents & Chemical Corp'n
Baker Chemical Co., J. T.
Carbide & Carbon Chemicals Corp.
Commercial Solvents Corp'n.
Mathieson Alkali Works
Merck & Co.
Pennsylvania Salt Mfg. Co.
U. S. Industrial Chem. Co.

Chimney Repairs
Custodis Chimney Co.,
Alphons

Chimneys, Acid Proof, Radial Brick
Custodis Chimney Co.,
Alphons

Chimneys, Reinforced Concrete
Custodis Chimney Co.,
Alphonse

Chromium, Metals & Alloys
Electric Metallurgical Sales Corp.

Clarifiers
Dorr Co.
Hardinge Co.

Coal Meters
(See Meters, Flow, Air, Etc.)

Coal Storage Systems
(See Machinery, Material Handling)

Cocks and Bibbs
(See Pipe and Fittings)

Coils and Bends
Albright Son & Co.
Hugh Co.
Lead Lined Iron Pipe Co.
Liberty Coppersmithing Co.
National Pipe Bending Co.
Resisto Pipe & Valve Co.

Coke Cooling Equipment
Dry Quenching Equipment Corp.

Coke Quenching Equipment
Dry Quenching Equipment Corp.

Compressors, Air or Gas
Beach-Russ Co.
Buffalo Forge Co.
Chicago Pneumatic Tool Co.
General Electric Co.
Powers Regulator Co.
Sullivan Machinery Co.
Worthington Pump & Mchry. Co.

Condensers, Barometric Surface or Jet
Buffalo Fdry. & Machine Co.
Chicago Pneumatic Tool Co.
Devine Mfg. Co., J. P.
Joubert & Goslin Co.
Schutte & Koerting Co.
Sun Shipbuilding & Drydock Co.
Swenson Evaporator Co.
Westinghouse Elec. & Mfg. Co.
Wheeler Mfg. Co.
Worthington Pump & Mchry. Co.

Containers
Blaw-Knox Co.
Corning Glass Works
Hoskins Mfg Co.
Niles Steel Products Co.
Pressed Steel Tank Co.

Controllers, Temperature, Pressure, Humidity, etc.
American Schaeffer & Budenberg Corp'n
Bristol Company, The
Foxboro Co.
Fulton Sylphon Co.
Mason Regulator Co.
Moto Meter Co.
Powers Regulator Co.

Conveying and Elevating Machinery
Allis-Chalmers Co.
Bartlett & Snow Co., C. O.
The Braun Corp.
Buffalo Forge Co.
Chatillon & Sons, John
Combustion Engineering Corp.
Dust Recovery & Conveying Co.
Fuller Co.
Fuller Lehigh Co.
Goodrich Rubber Co., B. F.
Gruendler Pat. Crusher & Pulverizer Co.
Jeffrey Mfg. Co.
Kent Mill Co.
Link Belt. Co.
Raymond Bros. Impact Pulv. Co.
Richardson Scale Co.
Robins Conveying Belt Co.
Robinson Mfg. Corp.
Standard Conveyor Co.
Sturtevant Mill Co.
Swenson Evaporator Co.
Webster Mfg. Co.
Yale & Towne Mfg. Co.

ABOVE—*A Panorama View of the Exhibition of Barcelona, 1929.*

LEFT—*Palace of Industrial Arts and Chemicals.*

An Export Opportunity for Unit Process Equipment

The Exhibition of Barcelona, 1929, is the American manufacturer's gateway to win, not only the rich fertile Spanish market (Spain is third wealthiest of world powers), but also to attract and interest the buyers of the 23 other countries of the world, who are being urged to attend through a world-wide advertising campaign.

At the Palace of Industrial Arts and Chemicals leading manufacturers from all parts of the world will display their process equipment. On the heights of famous Montjuich, 12,734,810 square feet of space is being occupied by the Exhibition. $21,372,000 is appropriated by the Government of Spain and the city of Barcelona —to apprise other nations of the tremendous industrial activity and economic progress already on foot in *new* modern Spain—and to impress the whole world of Spain's importance as an export gateway for world-wide acceptance of industrial products.

All of the world that matters—industrially . . . commercially . . . scientifically . . . artistically . . . will see and appreciate the exhibit of American manufacturers—*your line*—of process equipment at the International Exhibition of Barcelona, Spain, 1929.

Special low freight rates . . . arrangements for no tariff on materials for exhibit . . . exhibition space without charge for American manufacturers seeking the Spanish market.

For full information and vital statistics on the existing market for your product in Spain and Europe, address United States Delegate, Exhibition of Barcelona, Dept. 234, Steinway Hall, New York City.

International Exhibition Barcelona

May—1929—December

Conveyor Scales
Chatillon & Sons, John

Coolers
Buffalo Forge Co.
Chicago Pneumatic Tool Co.
Duriron Co.
Hardinge Co.
Smith Corp., A. O.
Struthers-Wells Co.

Copper
Nichols Copper Co.

Coppersmithing
Buffalo Fdry. & Machine Co
Joubert & Goslin Co.
Liberty Coppersmithing Co.

Couplings
Bartlett-Hayward Co.
Morse Chain Co.
Philadelphia Gear Works
Walworth Co.

Couplings, Flexible Overhead
Morse Chain Co.

Couplings, Flexible Shaft
Falk Corp.
Morse Chain Co.
Shepard Electric Crane & Hoist Co.

Cranes, Crawler or Locomotive
Link Belt Co.

Cranes, Grab Bucket, Jib & Traveling
Shepard Electric Crane & Hoist Co.

Cranes, Special
Shepard Electric Crane & Hoist Co.

Crucibles, Industrial
Bartley Crucible Co.
Dixon Crucible Co.
Thermal Syndicate, Ltd.

Crucibles, Laboratory
Amer. Platinum Works
Roots Co., P. H. & F. M.
Thermal Syndicate, Ltd.

Crushers, Grinding Mills & Pulverizers
(See Machinery, Crushing, Grinding and Pulverizing)

Crushers, Laboratory
Braun Corp'n
Gruendler Pat. Crusher & Pulverizer Co.
Williams Pat Crusher & Pulv. Co.

Crystallizing Equipment
Buffalo Fdry. & Machine Co.
Devine Mfg. Co., J. P.
Liberty Coppersmithing Co.
Pfaudler Co.
Swenson Evaporator Co.
Zaremba Co.

Cutting Apparatus, Oxy-Acetylene, Oxy-Hydrogen
International Oxygen Co.

Cyanides
American Cyanamid Co.

Cylinders for High Pressure Gases
Biggs Boiler Works Co.
Blaw-Knox Co.
Smith Corp., A. O.

Dehydrators, Centrifugal
Silica Gel Co.

Designing Engineers, Chemical Plant
Ferguson Co., H. K.

D'acetone Alcohol
Commercial Solvents Corp.

Disintegrators
Bartlett & Snow Co.
Day Co., J. H.
Gruendler Pat. Crusher & Pulverizer Co.
Jeffrey Mfg. Co.
Williams Pat. Crusher & Pulv. Co.

Distilling Machinery & App.
Barnstead Still & Sterilizer Co.
Corning Glass Works
Devine Mfg. Co., J. P.

Drain Pipe, Acid Proof
Duriron Co.

Drums, Steel
Niles Steel Products Co.
Pressed Steel Tank Co.

Dryers, Centrifugal
American Tool & Machine Co.
Buffalo Forge Co.
Fletcher Works
Prindle Mfg. Co., W. E.
Sturtevant Co., B. F.
Swenson Evaporator Co.
Tolhurst Machine Works

Drying Machinery and Equipment, Drum, Rotary, Vacuum
Bartlett & Snow Co., C. O.
Bethlehem Fdry. & Mch. Co.
Biggs Boiler Works Co.
Blaw-Knox Co.
Buffalo Forge Co.
Buffalo Fdry. & Mch. Co.
Devine Mfg. Co., J. P.
Freas-Thermo Electric Co.
Fuller Lehigh Co.
Fulton Syphon Co.
Industrial Associates, Inc.
Louisville Drying Co.
Nichols Copper Co.
Phila. Drying Mach. Co.
Prindle Mfg. Co., W. E.
Proctor & Schwartz, Inc.
Ruggles-Coles Division of the Hardinge Co.
Shriver & Co., T.
Stokes Machine Co., F. J.
Struthers-Wells Co.
Sturtevant Co., B. F.
Swenson Evaporator Co.
Vulcan Iron Works

Drying Trays
Corning Glass Works

Dust Collecting Systems & Engineers
Allis-Chalmers Mfg. Co.
Buffalo Forge Co.
Dust Recovering & Conveying Co.
Hardinge Co.
Northern Blower Co.
Raymond Bros. Impact Pulv. Co.
Research Corp.
Sturtevant Co., B. F.

Earthenware Acid Proof
U. S. Stoneware Co.
Knight, Maurice A.

Electrical Supplies, Fuses, (Fuses, Junction Boxes, Service Boxes, Underground Conduits)
Colts Pat. Fire Arms Mfg. Co.
General Electric Co.
Mine & Smelter Supply Co.

Electrolyic Cells
International Oxygen Co.,
Shriver & Co., T.

Electroplating, Chromium Cadmium, etc.
United Chromium, Inc.

Electroplating Salts
U. S. Industrial Chem. Co.

Enameled Apparatus, Acid Resisting
Pfaudler Co.

Enamels
General Plastics, Inc.

Engineers, Consulting (Chemical, Analytical, Metallurgical
Dorr Co.
Ferguson Co., H. K.
Fuller Lehigh Co.
(See Professional Directory)

Engineers, Furnace
Mettler & Co., Lee B.
Rockwell Co., W. S.

Engines, Gas, Gasoline, Oil & Steam
Chicago Pneumatic Tool Co.
Falk Corp.
Worthington Pump & Mchry. Co.

Ether, Acetic
American Solvents and Chemical Corp'n
U. S. Industrial Chemical Co.

Evaporators
Bethlehem Steel Co.
Blaw-Knox Co.
Buffalo Fdry. & Mch. Co.
Buffalo Forge Co.
Devine Mfg. Co., J. P.
Duriron Co.
Joubert & Goslin Co.
Liberty Coppersmithing Co.
Louisville Drying Co.
Pfaudler Co.
Swenson Evaporator Co.
Zaremba Co.

Exhausters, Rotary Positive Gas
Bayley Blower Co.
Beach-Russ Co.
Buffalo Forge Co.
Chicago Pneumatic Tool Co.
Connersville Blower Co.
Roots Co., P. H. & F. M.
Sturtevant Co., B. F.

Exhausters, Steam Jet
Elliott Co.
Wheeler Mfg., C. H.

Extraction Plants
American Tool & Machine Co.
Bartlett & Snow Co.
Buffalo Foundry & Machine Co.
Devine Mfg. Co., J. P.
Fletcher Works
Research Corp.
Tolhurst Machine Works

Fans, Standard & Acid Proof
(See Blower, Fan, Rotary and Turbine)

Faucets, Valves and Cocks, Stoneware, Acid Proof
Knight, Maurice A.
U. S. Stoneware Co.

Feeders
Bartlett Snow Co.
Fuller Lehigh Co.
Jeffrey Mfg. Co.
Link Belt Co.
Standard Conveyor Co.

Filter Aids
Celite Products Co.
Darco Sales Corp'n
Sargent & Co., E. H.

Filter Cloth, Metallic
Cleveland Wire Cloth & Mfg. Corp.
Newark Wire Cloth Co.

Filter Cloth, Textile
National Filter Cloth & Weaving Co.
Shriver & Co., T.

Filter Press Plates, Iron, Wood
Buffalo Forge Co.
Hauser-Stander Tank Co.
Perrin & Co., Wm. R.
Shriver & Co., T.
Sperry & Co., D. R.

Filter Presses
Buffalo Forge Co.
Dorr Co.
Perrin & Co., Wm. R.
Shriver, T. & Co.
Sperry & Co., D. R.

Filter Presses, Laboratory
Perrin & Co., Wm. R.
Shriver & Co., T.

Filters, Air
Northern Blower Co.

Filters, Clarifying
Shriver & Co., T.

Filters, Electrical
Research Corp.

Filters, Rotary
Dorr Co.
Joubert & Goslin Machine & Fdry. Co.
Louisville Drying Co.
Oliver United Filters Co.
Swenson Evaporator Co.

Filters, Suction, Acid Proof
Dorr Co.
Knight, Maurice A.
Oliver United Filters Co.
U. S. Stoneware Co.

Fire Clay
Armstrong Cork & Insulation Co.
Celite Products Co.
General Refractories Co.

Fittings, Cast Iron, Cast Steel, Flanged, Drainage, Malleable Iron
Stockham Pipe & Fittings Co.

Flanges
Stockham Pipe & Fittings Co.

Flexible Couplings
Bartlett-Hayward Co.
Falk Corp.
Jones Foundry & Machine Co.
Morse Chain Co.

Flooring, Industrial, Ventilating, Fireproof, Non-Slipping
Blaw-Knox Co.
Hendrick Mfg. Co.
Irving Iron Works Co.

Flotation Blankets
National Filter Cloth & Weaving Co.

Forgings
American Manganese Bronze Co.
International Nickel Co.

Fractionating Columns
Lancaster Iron Works

Fume Ducts, Acid Proof
Duriron Co.

Fume Tubes, Acid Proof
Duriron Co.

Furnaces
Combustion Engineering Corp.

Furnaces Electric
Ajax Electrothermic Corp.
General Electric Co.
Hevi-Duty Electric Co.
Hoskins Mfg. Co.
Rockwell Co., W. S.
Pittsburgh Electric Furnace Corp.

Furnaces, Industrial
Nichols Copper Co.
Pittsburgh Electric Furnace Corp.
Westinghouse Elec. & Mfg. Co.

Furnaces, Laboratory
Hevi Duty Elec. Co.
Nichols Copper Co.
Pacific Foundry Co.
Pittsburgh Electric Furnace Co.
Westinghouse Elec. & Mfg. Co.

Furnaces & Accessories, Industrial (Assay Melting, Caustic Pots, Electric, Heat Treating Oil Gas & Coke, Muffle, Porcelain-Enameling, Roasting and Smelting Water-Cooled)
Ajax Electrothermic Corp.
Allis-Chalmers Mfg. Co.
Best Corporation, W. N.
Bethlehem Fdry. & Mch. Co.
Braun Corporation
Braun-Knecht-Heimann Co.
Combustion Engrg. Corp.
Denver Fire Clay Co.
Hevi-Duty Electric Co.
Hoskins Mfg. Co.
Nichols Copper Co.
Pacific Foundry Co.
Quigley Furnace Specialties Co.
Rockwell Co., W. S.
Sargent & Co., E. H.
Sun Shipbuilding & Drydock Co.

Fused Silica
Thermal Syndicate, Ltd.

Fusel Oil, Refined
American Solvents & Chemical Corp'n
U. S. Industrial Chem. Co.

Gas Analysis Instruments
Republic Flow Meters Co.

Gas Coolers
Wheeler Mfg., C. H.

Gas Detarring Equip.
Research Corp.

Gas, Nitrogen & Oxygen
International Oxygen Co.
Liquid Carbonic Corp.
Matheson Co.

Gas Plant Equipment
Biggs Boiler Works Co.
Buffalo Forge Co.
Dry Quenching Equipment Corp.
Koppers Construction Co.

Gas Producers
Duff Patents Co.
Koppers Construction Co.

Gaskets & Packing Rings
Colts Pat. Fire Arms Mfg. Co.
Garlock Packing Co.

Gauges, Recording and Indicating, Pressure, Vacuum and Liquid Level
Amer. Schaffer & Budenberg Corp.
Bristol Company
Foxboro Co.
Moto Meter Co.
Republic Flow Meters Co.

Gear Cutting
Jones Foundry & Machine Co.

Gears, Compensating, Herringbone, Worm, etc.
Caldwell & Son Co., H. W.
Horsburgh-Scot Co.
Jeffrey Mfg. Co.
Jones Foundry & Machine Co.
Mine & Smelter Supply Co.
Philadelphia Gear Works
Vulcan Iron Works

Generators, Electric
Lincoln Electric Co.
Westinghouse Elec. & Mfg. Co.

Glass Tank Blocks
Corning Glass Works

Glassware, Industrial
Corning Glass Works

Glassware, Laboratory
Corning Glass Works

Governors
Mason Regulator Co.

Graphite
Dixon Crucible Co.

Gratings & Ventilators, Area, Sidewalk, Floor, etc., Metallic
Blaw-Knox Co.
Hendrick Mfg. Co.

Hard Rubber Products
American Hard Rubber Co.
Goodrich Rubber Co., B. F.

Heat Exchange Apparatus
Buffalo Forge Co.
Duriron Co.
Sun Shipbuilding & Drydock Co.
Wheeler Mfg. Co.

Heaters, Feed Water
Westinghouse Elec. & Mfg. Co.
Worthington Pump & Mchry. Co.

Heating Elements, Electrical
Globar Co.
Hoskins Mfg. Co.
Nat'l Electric Heating Co.
Powers Regulator Co.

Heating Systems & Accessories
Bayley Blower Co.
Buffalo Forge Co.
Fulton Syphon Co.
Globar Co.
Louisville Drying Co.
Mettler & Co., Lee B.
Nat'l Electric Heating Co.
Parks Cramer Co.
Sturtevant Co., B. F.

Hoists
Chicago Pneumatic Tool Co.
General Electric Co.
Shepard Electric Crane & Hoist Co.
Sullivan Machinery Co.
Vulcan Iron Works

Hose
Chicago Pneumatic Tool Co.

Hydraulic Presses
Perrin & Co., Wm. R.
Southwark Mch. Fdry. Co.
Watson-Stillman Co.

Hydro-Extractors
(See Centrifugals)

Industrial Coatings
Semet-Solvay Co.

Industrial Heat, Gas
American Gas Ass'n
Mettler, Lee L.

Instruments, Testing
Bausch & Lomb Optical Co.
Bristol Co., The
Westinghouse Elec. & Mfg. Co.
Weston Electrical Inst. Co.

Insulating Material, Heat, Electric & Molded
Armstrong Cork & Insulation Co.
Celite Products Co.
Colts Pat. Fire Arms Mfg. Co.
Corning Glass Works
General Plastics, Inc.

Insulators, Electrolytic Cell
Corning Glass Works

Insulation, Furnace
Armstrong Cork & Insulation Co.
Bartley Crucible Co.
Carborundum Co.
Celite Products Co.
Dixon Crucible Co.

Iron, Malleable
Walworth Co.

Iron, Stainless
Bethlehem Steel Co.
Central Alloy Steel Co.

Jars or Storage Pots, Acid Proof
(See Chemical Stoneware, Acid Proof)

Jets, Acid Proof
Duriron Co.

Jigs, Coal
Hardinge Co.

Kettles, All Types, Acid Proof
Duriron Co.

Kettles, Cast Iron
Bethlehem Fdy. & Machine Co.
Buffalo Fdy. & Mch. Co.
Pacific Foundry Co.
Sperry & Co., D. R.

Kettles, Lead Coated
Biggs Boiler Works Co.

Kettles, Steam-Jacketed
Bethlehem Fdy. & Mch. Co.
Biggs Boiler Works Co.
Blaw-Knox Co.
Buffalo Fdy. & Mch. Co.
Hugh Co.
Pfaudler Co.
Smith Corp., A. O.
Sperry & Co., D. R.
Struthers-Wells Co.

Kettles, Stoneware
Knight, Maurice A.
U. S. Stoneware Co.

Kettles, Varnish
Blaw-Knox Co.
Buffalo Fdy. & Machine Co.
Struthers-Wells Co.

Kilns, Rotary and Vertical
Bartlett & Snow Co., C. O.
Biggs Boiler Works Co.
Blaw-Knox Co.
Lancaster Iron Works
Louisville Drying Co.
Ruggles-Coles Eng. Co.
Struthers-Wells Co.
Sun Shipbuilding & Drydock Co.
Vulcan Iron Works

Laboratory App. & Supplies
Alberene Stone Co.
Braun Corporation
Braun-Knecht-Heimann Co.
Denver Fire Clay Co.
Duriron Co.
Freas-Thermo Electric Co.
McDanel Refractory Porcelain Co.
Mine & Smelter Supply Co.
Sargent & Co., E. H.
Tolhurst Machine Works

Laboratory Furniture
Kewaunee Mfg. Co.
Mine & Smelter Supply Co.

No dust— *where dust formerly* clogged up efficiency

THIS Vulcan Kiln at the Perth Amboy plant of the United Lead Company eliminates the dust which formerly caused great concern.

The hot lead here is dropped in front of a compressed air jet. The lead, thus atomized, is blown into the cylinder to be cooled and discharged to a conveying and elevating machine. The Vulcan cylinder used here is 10 feet in diameter by 35 feet long.

Have you any dust problem to deal with? Or any other problem where more efficient, especially designed Kilns, Dryers, Coolers or Roasters would heighten efficiency, speed production and reduce costs of fuel, labor and maintenance?

Vulcan Products

Hoists,
Electric and Steam
Locomotives,
Steam, Gasoline, Electric
Rotary Kilns, Dryers, Coolers and Roasters
Mine Ventilating Fans
Cages and Skips
Sheave Wheels
Coal Crushers
Gray Iron Castings
Open Hearth Steel Castings
Gears, Moulded and Cut Teeth
Special Machinery

Vulcan Engineers have the answer for you. They have solved many and varied problems by designing and building kilns and allied equipment especially to suit conditions that their advice will unquestionably help you.

Get in touch with Vulcan Kiln Engineering Service by writing for particulars and the latest Vulcan Bulletins.

VULCAN IRON WORKS

Established 1849

New York Office
50 Church Street

1742 Main Street, Wilkes-Barre, Pa.

Allentown, Pa.

Chicago Office:
McCormick Bldg.

VULCAN of WILKES-BARRE KILNS

Lacing, Belt
(See Belt Lacing)

Lead Burning
Niagara Blower Co.

Lifts, Air
Beach-Russ Co.
Chicago Pneumatic Tool Co.
Sullivan Machinery Co.
Wheeler Mfg. Co.

Lightning Rods, Chimney
Custodis Chimney Co.
Alphons

Lime, Chemical and Hydrated
Hunkins-Willis Lime & Cement Co.
Louisville Cement Co.
Marblehead Lime Co.

Loaders & Unloaders, Portable
Jeffrey Mfg. Co.
Link Belt Co.
Vulcan Iron Works

Locomotives Compressed Air
Vulcan Iron Works

Locomotives, Electric
General Electric Co.
Jeffrey Mfg. Co.
Vulcan Iron Works

Locomotives, Gasoline
Vulcan Iron Works

Locomotives, Industrial
Vulcan Iron Works

Locomotives, Steam
Vulcan Iron Works

Lubricants
Cook's Son, Inc., Adam

Machinery, Agitating
Alsop Engineering Co.
Bartlett & Snow Co.
Bethlehem Fdry. & Mch. Co.
Biggs Boiler Works Co.
Blaw-Knox Co.
Buffalo Fdy. & Mch. Co.
Day Co., J. H.
Dorr Co.
Duriron Co.
Hugh Co.
Ideal Industrial Mchry. Co.
Mixing Equipment Co.
Pacific Tank & Pipe Co.
Sun Shipbuilding & Drydock Co.

Machinery, Coal Handling
See Automatic Handling Equipment

Machinery, Conveying and Elevating
(See Conveying and Elevating Machinery)

Machinery, Crushing, Grinding, and Pulverizing
Bartlett & Snow Co.
Bethlehem Steel Co.
Day Co., J. H.
Fuller Lehigh Co.
Gruendler Pat. Crusher & Pulverizer Co.
Hardinge Co.
Mine & Smelting Supply Co.
Smith Engineering Works
U. S. Colloid Mill Corp.
Williams Pat. Crusher & Pulv. Co.

Machinery, Drying
(See Drying Machinery)

Machinery, Emulsifying
U. S. Colloid Mill Corp.

Machinery, Homogenizing
U. S. Colloid Mill Corp.

Machinery, Material Handling
Bartlett & Snow Co.
Combustion Engineer. Corp.
Dust Recovery & Conveying Co.
Jeffrey Mfg. Co.
Kopers Construction Co.
Link-Belt Co.
Richardson Scale Co.
Shepard Electric Crane & Hoist Co.
Standard Conveyor Co.
Yale & Towne Mfg. Co.

Machinery, Mixing and Kneading
Abbe, Inc., Paul O.
Alsop Engineering Co.
Baker, Perkins Co., Inc.
Bartlett & Snow Co.
Biggs Boiler Works Co.
Day Co., J. H.
Fuller-Lehigh Co.
Ideal Industrial Mchry. Co.
Miller & Co., Max B
Mixing Equipment Co.
Robinson Mfg. Co.
Ruggles-Coles Eng. Co.
Smith Engineering Works
Stokes Machine Co., F. J.
U. S. Colloid Mill Corp.
Webster Mfg. Co.

Machinery, Paint, Varnish & Lacquer
Bartlett & Snow Co.

Machinery, Refrigerating
Struthers-Wells Co.
Worthington Pump & Mchry. Co.
York Ice Machinery Corp.

Machinery, Screening
Bartlett & Snow Co.
Hardinge Co.
Jeffrey Mfg. Co.
Kent Mill Co.
Link Belt Co.

Machinery, Special
Biggs Boiler Works
Blaw-Knox Co.
Proctor & Schwartz, Inc.

Machinery, Thickening & Dewatering
American Tool & Mach. Co.
Dorr Co.
Hardinge Co.
Oliver United Filters Co.
Tolhurst Machine Works

Machinery, Transmission
(See Transmission Equipment)

Machinery, Weighing
Buffalo Scale Co.
Chatillon & Sons, John
Colts Pat. Fire Arms Mfg. Co.
Merrick Scale Co.
Richardson Scale Co.

Magnetic Separators
Ding's Magnetic Separator Co.

Manganese, Metals & Alloys
Electro Metallurgical Sales Co.
Metal & Thermit Co.

Material Handling Equip't
(See Machinery, Material Handling)

Metal Coating and Plating
Amer. Machine & Fdry. Co.
Struthers-Wells Co.
United Chromium, Inc.

Metallographic Equipment
Bausch & Lomb Optical Co.

Meters, Flow, Air Gas, Steam, Water, Coal
Bailey Meter Co.
Connersville Blower Co.
General Electric Co.
Republic Flow Meters Co.
Roots Co., P. H. & F. M.

Microscopes
Bausch & Lomb Optical Co.

Mills, Attrition, Rail, Pebble and Tube
Abbe, Inc., Paul O.
Day Co., J. H.
Hardinge Co.
Robinson Mfg. Co.

Mixers
(See Machinery, Mixing & Kneading)

Motors, Electric
Century Electric Co.
General Electric Co.
Lincoln Electric Co.
Mine & Smelter Supply Co.
Wagner Electric Corp.
Westinghouse Elec. & Mfg. Co.

Muffles
Carborundum Co.
Denver Fire Clay Co.

Nickel, Sheet, Rod, Wire, etc.
Nichols Copper Co.

Nitrators
Blaw-Knox Co.
Buffalo Fdy. & Machine Co.
Tolhurst Machine Works

Nitrogen
International Oxygen Co.
Matheson Co.

Nozzles, Spray
Chicago Pneumatic Tool Co.
Duriron Co.
Hardinge Co.
Monarch Mfg. Works
Schutte & Koerting Co.
Spray Eng. Co.

Oil Burning Systems
Bethlehem Steel Co.

Oil Circulating Systems, Industrial Heating
Parks Cramer Co.

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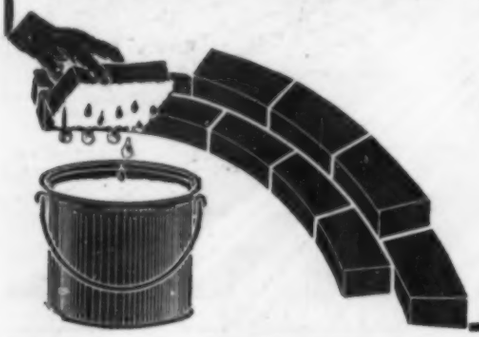

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